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Big Men for Big Industry.

IT is impossible to keep pace with all the thoughts that are being publicly expressed, either by speech or in writing, regarding the best ways to adopt for securing the most efficient and progressive conduct of industry in works and offices at home and of trade operations in markets overseas. One has listened to the speeches of those who knew, or thought that they knew, for a score of years, and while occasionally there has been a harvest of new propositions, the monotonous sameness of the ideas has been truly remarkable. Even the word rationalisation, which has been employed amongst us so much during the last few years, is but a re-discovery, for long before British industrialists began to see clearly regarding what it meant or what it involved, we were recording week by week in these pages how German electrical and other heavy industries were strengthening their positions by reconstructions, amalgamations, Kartels, and so forth, for a world war of trade, and the German readiness for linking up their great works for the rapid production of war munitions on a colossal scale was attributed to their advanced state of organisation. At the beginning of the year 1919, when our works were passing through that difficult period of change-over from war production to peace manufacturing, we imagined a voracious appetite throughout the world for our output. We had to give all the employment we could at that delicate time, and so we found ourselves carrying on with a capacity far in excess of order-book requirements or visible world demand. The world was too poor to buy—but we went on producing. To-day we still have much of our productive capacity unutilised and the modernisation of equipment and the reorganisation of certain industries has further greatly increased our output capacity. But all sorts of home and world problems affecting industry have dogged our steps as we have made this, that, and the other advance, and our advisers still have little more than the former object lesson of rationalisation to point to as a means of relief and permanent prosperity—we are not thinking of our legislators at the moment. Many have been the definitions given to that word rationalisation; to some authorities it is scientific management, quite an old term which has been the subject of much controversy in days gone by in engineering circles and publications. To

others it means something which is only a part of that comprehensive term, while to other minds it means large and difficult financial and works changes.

In his address to the Western Centre of the I.E.E., abstracted in the REVIEW last week, Mr. S. B. Haslam said that rationalisation would mean increased production, and that is certainly one of the great effects it has been found to produce as a competitive power against us, because it reduces cost. But our position seems to be somewhat like that obtaining after the war, for we have not the power to absorb this increased production. We have got to find more markets—many men have been saying it for years and many others have been telling us how they think we should proceed in order to succeed in such endeavours. The ground must already be so familiar to readers of this journal that we need not particularise, but if there is one point more than another that we wish to lay emphasis upon just now, it is the need that exists for the development of a bigger type of man in the electrical industry. If, as has been suggested, the establishment of a higher type of productive organisation may lead us to employ a larger number of routine workers and cause a shortage of all-round experienced leaders, how can we regard that development with equanimity? We want more, not fewer, all-round experienced leaders on the productive side of industry, and beyond all question, to our minds, what we need on the export selling side is a substantial addition to the number of men of a high-class type; and they need not be brought in from other industries. Possibly, or shall we say probably, they are in our ranks already and only stand in need of a fair opportunity and adequate acknowledgment. We all know how seldom it is that technical and commercial qualifications are found fully developed in a man possessed of an acceptable presence and a fluency in foreign market languages. Yet we are constantly having placed before us a long list of qualifications, attainments, and virtues which, though described as urgent essentials, can only come as the result of a wide and deep experience. And when such men are found, or shall we say when they are developed, partly by their own enterprise, initiative, and hard work, and partly under a wise and generous and far-seeing policy of their employers, they are worth their weight in gold. Why do we not recognise this more frequently than we do and reward men according to their real value? Niggardliness in the recognition of men of high qualifications either on the administrative or the trade-getting side is an inexcusable and a very short-sighted failing. How long will it be before we accustom ourselves to modern money values, taxation imposts, and costs of living?

Do we not need to get on to a larger salary and remuneration basis, encouraging big men who are able to carry on under rationalised conditions, reducing costs of production so that substantial trade representatives shall find the new markets, increase the demand on the works, and reap a reasonable reward for themselves? Are present-day boards and heads of concerns ready to adopt a larger policy and assure to men of merit a reward appropriate to the results of their efforts? If they are, we need fear no lack of suitable men for what everybody now seems to regard as an extremely valuable service to the nation.

The Disposal of Surplus Energy.

THE ability to extract good out of evil fortune is one sign of a high *morale*, and but for the devastation of Lorraine in the war, and the necessity for the reconstitution of its main industries, it is probable that the spur would have been wanting to bring about the co-operation among the iron and steel companies in the province, for the purpose of disposing of electrical energy produced from surplus blast-furnace gas, which formed the subject of the I.E.E. paper last week. Interconnection between metallurgical works not only brings about the benefits associated with similar arrangements between coal-fired stations, but possesses considerable advantages in addition. Among the latter may be mentioned the ability, by making use of diversity in demands, to deal with peaks of an extremely fluctuating character, and to utilise a low grade of gas which cannot economically be stored. Such a co-operative scheme is, however, incomplete in one important respect; the amount of gas produced at night and during week-ends is more than can be consumed in the works. In Lorraine a connection is made with the 120-kV transmission system of the State and with a group of Swiss hydro-electric stations, but the chief advantage of the latter connection would be apparent only if large water storage capacity were available.

Interconnection in the iron and steel and coal-producing districts is, of course, no new thing in Great Britain, and, the disposal of surplus energy to a power company has been a recognised practice here for many years. We referred on October 18th, p. 631, to the scheme of the South Yorkshire Coal Owners' Association and its position with regard to the grid, and in last week's issue we gave particulars of the Staveley Coal and Iron Company's up-to-date electrical system, particulars which were amplified during the discussion on the I.E.E. paper. In many cases, however, connections in this country have been made piece-meal and at lower voltages than would have been the case had the schemes originally been designed as a whole, as in Lorraine.

The French system is, nevertheless, deficient in some ways in the light of modern practice, but there is reason to suppose that such deficiencies, which are due to the need for rigid capital economy in the early stages, will be rectified in time. We refer to the use of pin type insulators on super-voltage lines and the lack of selective protection for the overhead lines. Greater operating regularity will no doubt also be secured with the installation of further steam turbines, which will reduce the proportion of the output from the gas engines to some 40 per cent. of the whole, although even this proportion is considered by some engineers to be higher than is consonant with complete reliability. Regard must necessarily be paid to the condition that the production of power at a works must always be a subsidiary operation, and that its cost is usually a small proportion only of the total production cost of the principal commodity. In spite, therefore, of the higher thermal efficiency of the gas engine, its employment is limited to providing a relatively small share of the electrical output.

Our Overseas Markets.

IN this issue we survey the Board of Trade statements with regard to overseas electrical trade in 1928, and once again have to complain of the long delay in their publication.

This analysis of markets is useful. While fluctuations in trade are perhaps mainly due to economic cycles, or to non-recurring causes, the analysis will point in many instances to an adverse tendency which may be arrested, or to opportunities of which fuller advantage may be taken. Where, for instance, there is a decline in imports of a certain class there may be causes susceptible to treatment. It may be due to foreign competition, which can be studied with a view to meeting it effectively; to a change in methods, *e.g.*, a fall in the imports of d.c. machines due to the adoption of a.c., which would seem to point to extra effort in the sale of a.c. plant; to a previous over-supply, which has left a surplus that improved marketing methods might dispose of; or to a number of other influences.

On the other hand, increases in certain directions may be a guide to further opportunities. Large imports of generating plant and cable indicate future business in current-consuming apparatus, for instance. In its wider aspect the analysis shows world trade tendencies and the growing or decreasing value of the various markets. In this connection our survey reveals a number of interesting facts. One of outstanding importance may be remarked upon; at several points a note is made of improved trade with Argentina. It will be seen that during 1928 this customer took larger quantities of British a.c. generators, motors, both a.c. and d.c., radio apparatus, and telegraph and telephone apparatus. In fact for goods of the last class Argentina proved our best

customer last year. Chile also imported a greater quantity of British telegraph and telephone apparatus. The South American countries as a whole showed a decided improvement. In spite of a general decline in exports of electrical machinery the share of these markets collectively rose in value from £576,961 to £773,797.

The acknowledged supremacy of the British submarine cable manufacturers is confirmed by the fact that our electrical exports to the United States and France consisted very largely of this class of product. Our curves show very clearly the importance of the Dominions to the electrical industry. It is to be observed, however, that while the share of the Dominions fell during 1928, that of foreign countries increased substantially.

Our two most important customers were again Australia and India. The former imported smaller quantities of British electrical machinery and goods and apparatus. India's share of our electrical machinery exports showed a satisfactory increase and she supplanted Australia as the leading importer of this class. Her imports of electrical goods and apparatus remained steady at about £1,500,000. South Africa and New Zealand both failed to reach the 1927 level, but Canada, a small market, showed an improvement.

The growth of the Japanese home industry was further indicated by a large decline in her imports of British goods. On the other hand, Egypt is an expanding market and will probably compensate us for the loss of Japanese custom. The impressions gained from a study of these statistics and by following the curves over the last few years are as follows:—The Empire continues to provide the best outlet for our electrical exports, but there are indications that there must be no relaxation of effort on our part. The Latin-American markets are likely to prove of great advantage to us if they are assiduously cultivated. Exports of electrical goods and apparatus are about double those of machinery in value; and they were maintained in 1928, while for the first time since 1922 machinery exports showed a decline in value although the weight advanced to a small extent.

Possibilities in South America.

SIR MALCOLM ROBERTSON, who recently resigned the position of British Ambassador to the Republic of Argentina, is never tired of stressing the opportunities for British manufacturers and traders in Argentina. His views must carry considerable weight, for during his service as British representative in Buenos Aires he has made a very close study of conditions and kept in intimate touch with Anglo-Argentine trade.

Upon his arrival in this country a week or two ago he again emphasised the need for British traders to concentrate attention upon this important market. He said that Argentina was developing very rapidly and possibilities of trade were increasing. Very cordial friendship existed between the Republic and Great Britain, and it was fully worth the while of those interested in Anglo-Argentine trade to pay a visit of investigation. If they took the trouble to ascertain exactly what Argentina wanted they would have no cause to regret their efforts.

Support for Sir Malcolm's opinion was forthcoming at a dinner given by the Government to South American diplomatic representatives last week. Lord d'Abernon, describing Sir Malcolm as one of the best judges of South American events, said that his optimistic forecast would be fulfilled if negotiations were continued on the broad basis which the British Economic Mission had endeavoured to establish. Lord d'Abernon maintained that it was no infidelity to the Imperial conception to trade with foreign countries. He thought, however, that those foreign countries should reciprocate, even if they had to be warned that failure to do so might mean a diminution in our imports from them.

The speaker also pointed to the esteem in which British character was held by South American countries. Unfortunately, he said, commercial development had not achieved the high level which might have been anticipated from these predilections. Contrasted with future possibilities the present development was only moderate.

This is an endorsement of views which have been expressed frequently in our pages, but we think that reiteration is justifiable and indeed necessary at a time when foreign markets are so essential to the well-being of our industry.

Australian Trade Policy.

FOLLOWING the passing allusion in our last week's leader to the unaccommodating trade policy of Australia and to the detrimental effect upon the industrial interests of the Mother Country, there comes from Melbourne (*The Times*, December 13th) a report that the Australian Association of British Manufacturers has issued a pronouncement expressing deep concern at the effects of the new tariff both on British trade and on Australia's economic and financial position. It protests against the making of drastic alterations without due consideration, and holds that as revised, it is calamitous to many British manufacturers and traders, while its permanent advantage to Australia is questionable. It asserts that our manufacturers are more likely to go to Australia under the old tariff than under the revised one if it be confirmed, and adds that they are now unlikely to pursue the question of opening works there. Unstable policy in Australia does not assist our manufacturers in their efforts to more efficiently meet the needs of the market.

In addition to the protest drawn up in Australia another in the form of a letter has been addressed to the Secretary of State for Dominion Affairs and the President of the Board of Trade on behalf of our Home Association of British Chambers of Commerce. This letter, which is dated December 13th, expresses serious alarm among all engaged in trade between this country and Australia, at the effort which the Tariff will have upon our industries and to our export trade. It is believed that the increases "will have a serious effect on employment in this country. . . . Many trades will be almost prevented from exporting under the new tariffs." Our Government representatives are urged to forward a vigorous protest to the Australian Government, and we hope that in light of such serious warnings they will not fail to do their duty to the workers of these islands.

Low-temperature Heating.

THE use of electricity for providing heat by other means than the luminous radiator is being actively canvassed at the present time. An abstract is published in this issue of a paper recently read by Mr. R. Grierson before the Institution of Heating and Ventilating Engineers, while on Thursday of next week two papers are to be read before the Institution of Electrical Engineers, by Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant and by Mr. T. G. N. Haldane, all dealing with different methods of using electricity to the same end.

Mr. Grierson advocates the low-temperature panel system and emphasises that point that to obtain the best results thermostatic control is necessary. We think that the ease with which electricity lends itself to thermostatic control is likely to become increasingly important among those "incidental" factors which have so often in practice shown electricity to possess advantages of an insufficiently appraised economic value.

Christmas, 1929.

WITH this number of the ELECTRICAL REVIEW we enjoy the privilege of coming a little more humanly into touch with our readers, as we wish them from the bottom of our hearts "A Merry Christmas!" Before our next week's issue appears the Christmas vacation will have passed and we shall be in the midst of everyday electrical affairs again, but to-day we look forward to all those happy, homely, and human experiences which are so welcome to us as a people. As usual let us have a thought for those to whom memory will seem to be unkind, and one for those who stand in need of what we have to give them; also while festive spirits run high in the social circle we will give our "Cheerio!" to the men who are in charge of the electrical and other services which are essential to our common security and enjoyment.

A Cake and Biscuit Manufactory.

An indication of the extent to which electrically-driven machines and electric ovens are used in a large modern bakery.

CONSIDERABLE interest is attached to the factory in Birmingham whence come the packed cake and biscuits which are so well known in Great Britain and are now in demand overseas also. The business of Alfred Hughes & Sons, Ltd., has always been noted for quality production since its inception nearly 50 years ago, and at the 10-acre factory recently opened at Adderley Park, practically all the ingredients used are produced within the Empire. A large proportion of the sugar used is made from English beet, while all the flour is milled homegrown wheat, and in this connection it is interesting to note that not only are the best biscuits made in this country, but only English flour can be used for making biscuits of high and consistent quality.

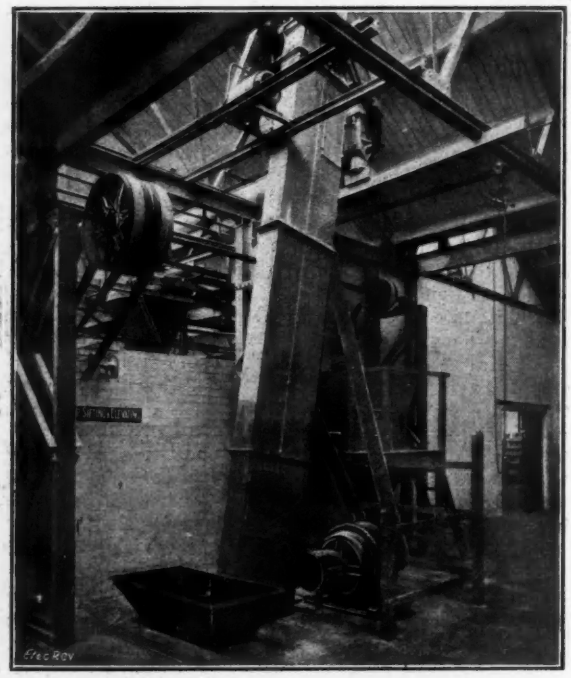


Fig. 1.—Motors driving Flour-sifting and Elevating Plant.

All the machines are driven by electric motors, power being derived from the mains of the Birmingham Corporation at 5,000 volts, three-phase, 25 cycles, and transformed to 440 volts for use in the factory. By utilising the system of individual drive Messrs. Hughes have been aided in their efforts to obtain a bakery of high efficiency, as well as of notable cleanliness, airiness, and comfortable operating conditions generally. Fig. 2 shows a small section of the raw materials preparation department, the motor driving the sugar grinding machine being of 11 h.p. at 1,440 r.p.m. Two other motors in this department are seen in fig. 1, that on the floor being of 35 h.p. at 715 r.p.m., and that on the girders being of 3.5 h.p.; the former drives flour-sifting machines and the latter operates elevating plant. Practically all the motors in the installation under consideration were supplied by the British Thomson-Houston Co., Ltd., whose Birmingham factory is devoted solely to the production of electric motors for industrial requirements. The B.T.-H. starter for the 35-h.p. motor is of the pillar type for floor mounting, a type which is widely favoured in industrial installations on account of the ease of fixing exactly where required and the ready accessibility of all parts for inspection, while the complete system of interlocks and protective features ensures the safety of both the operator and the machine. These equipments can be arranged for control by push buttons if required, and the fact that any number of push-button stations can be provided in the most desirable positions is often of the greatest value.

Of the mixing machines for the ingredients of biscuits the larger are capable of thoroughly incorporating seven to eight cwt. at each mixing. After this process the biscuit dough is passed through a series of " brakes " which roll it into smooth long pieces, which are fed into the cutting and stamping machines, which automatically shape, imprint, pattern and name the biscuits, and deposit them on the baking trays. At no stage in the process is the dough touched by hand, and the loaded trays pass direct to the travelling ovens of a modern type. A chain conveyor takes the trays through the oven chambers at a speed which can be varied to suit the type of biscuit, each oven having a capacity of between 4 and 5 cwt. per hour. On issuing from the mouth of the oven the trays are automatically transferred to conveyors which take them to the packers, sufficient time elapsing for the biscuits to cool before they are taken off by the girls who pack them into tins. In the view of three of the biscuit-making equipments (fig. 4) the protecting covers of the electric motors driving the nearest equipment have been removed. The motors driving the dough brakes are of 10 h.p. at 705 r.p.m., and those of the cutting machines of 8 h.p. at 710 r.p.m. The component machines of each equipment are arranged in line, the entry to the ovens being shown in the illustration. The necessary speed adjustment of the conveyors is obtained by the use of a variable-speed motor in each case.

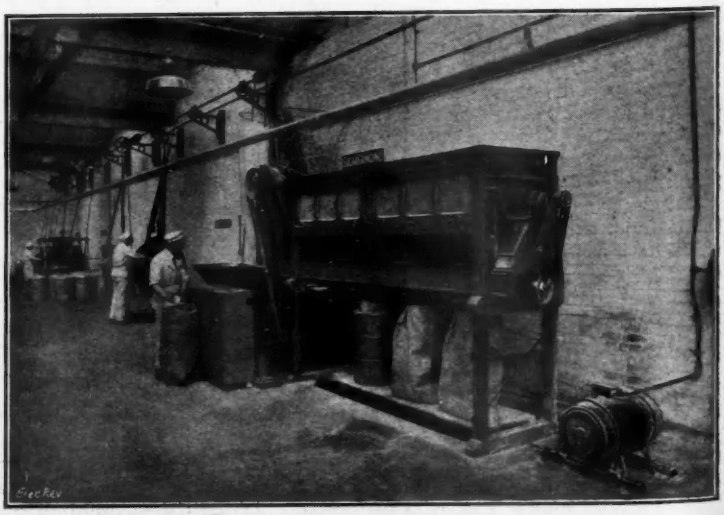


Fig. 2.—Motor of 11 h.p. driving Sugar Mill.

The two " depositing " machines (fig. 3) are fitted with rollers, so that they can be moved to any position required, and in the illustration both are quite close to the mouth of the oven. The driving motors are of 3 h.p. at 700 r.p.m., and 2 h.p. at 1,410 r.p.m., respectively, being plugged in by flexible cable at suitable plug points.

Fig. 3.—Portable Depositing Machines driven by Motors of 3 and 2 h.p.

will be correctly baked. This machine, as well as most of the others referred to, is of Messrs. Baker Perkins make, which firm also supplied the two-tier draw-plate cake ovens illustrated in fig. 5. They are electrically heated and are ideal for cake baking, for which purpose the heat must be easily controlled and maintained at a specific temperature between narrow limits. To this end the heating elements are provided with B.T.-H. automatic control equipment, the desired baking temperature being set by the operator moving an indicator to the corresponding temperature mark on the graduated dial. As soon as the current is switched on, the temperature of the oven rises until the desired limit is reached and is then automatically maintained until the operator alters its value. A special sensitive relay is provided in the control circuits, and when the temperature falls, the temperature-indicator contacts short-circuit a resistance and cause enough current to pass through the relay coil to close the relay, which is in circuit with the operating coil of the contactors for switching the heating elements into or out of circuit. When the relay is closed, the short-circuit is removed from the resistance, and, as soon as the temperature rises, the temperature-indicator contacts short circuit the relay coil, thereby causing the relay con-

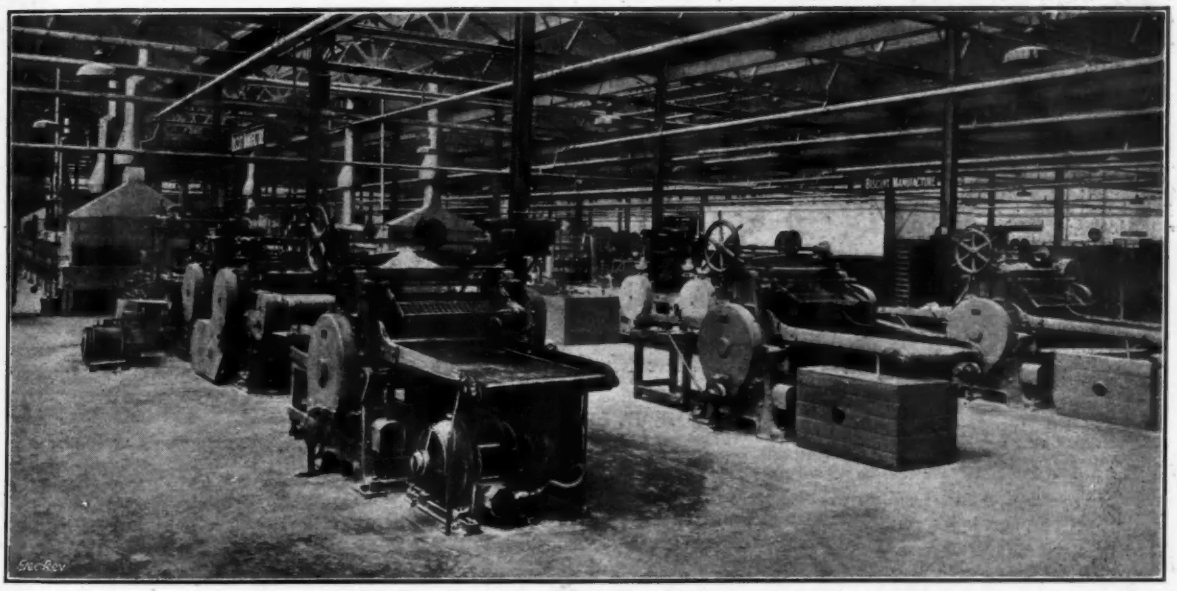


Fig. 4.—Dough Brakes, Biscuit-cutting Machines, and Biscuit Ovens.

Several varieties of biscuits require decoration and are transferred from the last conveyor of the oven system to a special section. An interesting machine for coating biscuits with chocolate is that shown in fig. 6, the driving motor being of 2.5 h.p. at 700 r.p.m. While being slowly conveyed through this machine the biscuits are coated with chocolate in viscous form and on emerging from this section they are further decorated, if required, and finally conveyed through a special cooling chamber, the exit of which is in the packing department.

A machine for making ice-wafer biscuits in one operation is shown in fig. 7. It is chain driven by a motor of 3 h.p. at 685 r.p.m. The process is a continuous one, the batter being sprayed on to the bottom sections of hot moulds, on to which the top sections immediately descend, the moulds then passing through the incorporated oven in such a manner that the correct amount of heat is applied to both the top and bottom halves of the mould to ensure that when the wafers are subsequently automatically ejected they

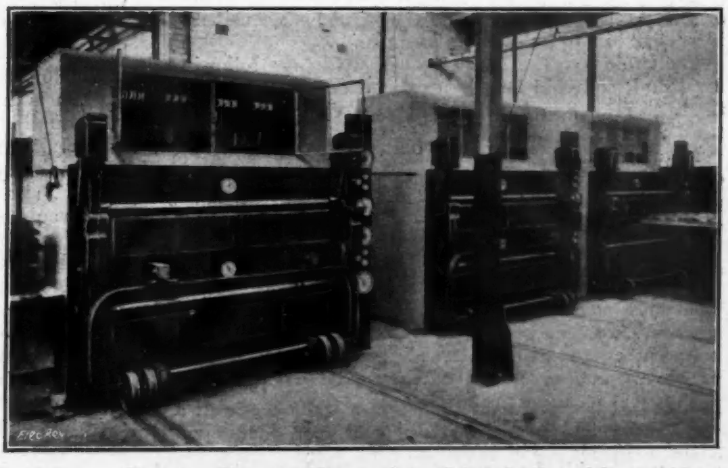


Fig. 5.—Two-tier Draw-plate Cake Ovens with Adjustable Thermostatic Control.

tacts to open and so make the control equipment ready to go through the same cycle again on a fall in temperature.

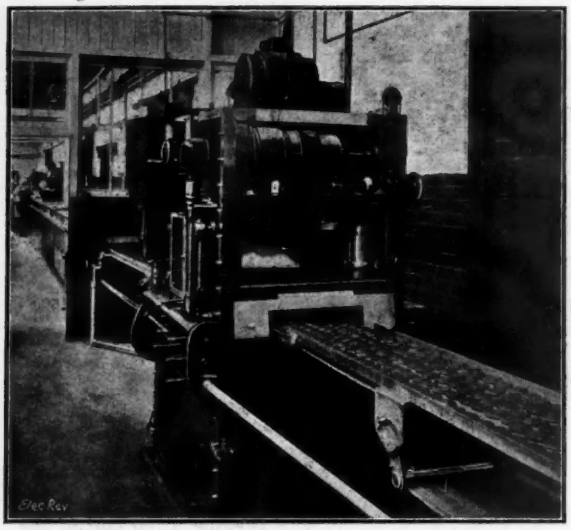


Fig. 6.—Chocolate-coating Machine.

The front glass doors of the contactor box of the oven in the forefront of the illustration are shown opened, so that the relay and contactors can be more clearly seen.

With these ovens Messrs. Hughes are able to obtain remarkable uniformity in baking all kinds of cakes, which, like biscuits, are made from Empire products, mixed by up-to-date electrically-operated plant, and, after baking, hygienically packed. The loss of heat is

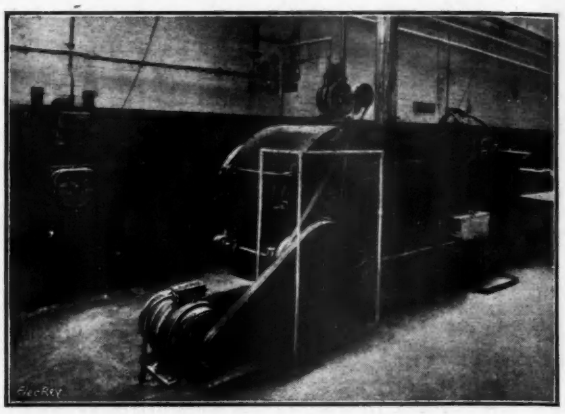


Fig. 7.—Motor driving Ice Wafer Machine, B.T.-H. Starter also shown.

remarkably small and it is said that the ovens will remain almost at baking heat after the current has been switched off for twelve hours.

Sags and Tensions of Overhead Transmission Lines.

A Method of Solving Problems in the Mechanical Design of Overhead Conductors.

By H. SMITH.

THERE are many methods of solving the problems attached to the mechanical design of overhead transmission-line conductors, but very few lend themselves to quick and easy solution, which, for the busy engineer, is essential.

The method to be explained in the following article is really of a well-known form based on the parabola, as will be seen later.

The usual parabolic formulæ are reducible to cubic equations, when either the sag or tension is calculated under the conditions set out by the Electricity Commissioners' Regulations, and it is in relation to the method of solving these equations that the author has considered it worth while to publish his formulæ.

The cubic equation used is built up in the following way, and, to avoid lengthy explanations, it is assumed that the reader is familiar with the derivation of the fundamental formulæ used.

In all problems dealing with the mechanical design of overhead conductors the initial conditions are fixed, and any other conditions of sag, tension, or temperature are determined.

From the parabola the initial conditions for sag and tension are :—

$$T_1 = w l^2/8 s_1 \quad .. \quad .. \quad (1)$$

and

$$L_1 = l + 8/3 s_1^2/l \quad .. \quad .. \quad (2)$$

The initial conditions in this country are fixed by the Electricity Commissioners, T_1 being one half the breaking load of the conductor, and w being the resultant of wind and weight of an ice loaded conductor, coated with 3/16-in. radial ice in the case of low-voltage lines, and $\frac{3}{8}$-in. radial ice in the case of high-voltage lines, and subjected to a wind load of 8 lb. per square foot on the projected area of the ice-coated conductor; s_1 is the sag under these conditions, l the span, and L_1 the length of conductor.

For any other condition a new set of equations is necessary—

$$T_2 = w l^2/8 s_2 \quad .. \quad .. \quad (3)$$

$$L_2 = l + 8/3 s_2^2/l \quad .. \quad .. \quad (4)$$

T_2 = new tension, s_2 = new sag, L_2 = new length of conductor, and w = condition of weight of conductor for which the final conditions are calculated.

That is, if the new conditions are for conductors at a higher temperature in still air, w = weight per foot of conductor and, if at a higher temperature under wind load, it is the resultant of wind and weight.

Normally, we wish to find under our final conditions the maximum sag of the conductor, and in this country it is given by the Commissioners as being attained after 100° F. rise in temperature and in still air.

As would be expected, the conductor is elongated due to this rise in temperature, and it follows from the fundamental equations that the tension decreases, and, as the conductor has elastic properties, there will be a decrease in length.

Thus the original length L_1 is increased by $\alpha\, t^\circ l$ nearly and decreased by $(T_1 - T_2)\, l/A\, E$ nearly, the assumption being that $l = L$, where α = coefficient of expansion, t° = rise in temperature, A = cross-sectional area, and E = modulus of elasticity. Writing the foregoing in algebraic form—

$$L_1 + \alpha\, t^\circ l - (T_1 - T_2)\, l/A\, E = L_2 \quad .. \quad (5)$$

Substituting the various equivalents for L_1, T_2, and L_2, we have—

$$l + 8/3\ w^2 l^4/64\ T_1^2\ l + a t^\circ l - T_1 l/AE + w l^2/8\ AES_2 = l + 8/3\ S_2^2/l \quad .. \quad .. \quad .. \quad .. \quad (6)$$

This equation contains only one unknown, which is S_2, the sag for final conditions, and is reducible to—

$$S_2^3 - 3 l^2/8\ (w^2 l^2/24 T_1^2 + a t^\circ - T_1/AE)\ S_2^2 - 3\ w\ l^4/64\ AE = 0 \quad .. \quad .. \quad .. \quad (7)$$

Now T_1/AE is the strain in the material or stress/$E = m$, and equation (7) becomes

$$S_2^3 - 3 l^2/8\ (w^2 l^2/24\ T_1^2 + a t^\circ - m)\ S_2^2 - 3 w l^4 m/64\ T_1 = 0 \quad .. \quad .. \quad .. \quad (8)$$

The solution of this equation is a cumbersome business, but the following mathematical treatment simplifies it considerably.

First, re-write equation (8) as

$$S_2^3 \pm A S_2 - b = 0 \quad .. \quad .. \quad .. \quad (9)$$

the coefficient of S_2 can be either positive or negative.

Taking the positive value first:

then let $S_2 = y - a/3\ y$ .. .. .. (10)

then $y^6 - by^3 - a^3/27 = 0$ .. .. (11)

which is a quadratic in y^3; therefore

$$y^3 = b/2 \pm \sqrt{b^2/4 + a^3/27}$$

from which y can be found and when substituted in (1) gives S_2.

If, on the other hand, we take the negative value of (9)

then $S_2 = y + a/3\ y$ .. .. .. (13)

from which $y^6 - by^3 + a^3/27 - 0$.. .. (14)

and $y^3 = b/2 \pm \sqrt{b^2/4 - a^3/27}$ .. .. (15)

With the aid of the foregoing equations (8) to (15) a simple table can be made of a series of calculations and a form which has been extensively used is shown in Table I, which has been filled in for the sags after a 100° F. rise in temperature for 3/.147 copper stranded conductor for e.h.p. lines.

TABLE I.—SAG CALCULATION.

Conductor: .05 sq. in. h.d. Copper 3/.147 strand.

w = .885 lb. per ft. w = .2 lb./ft. a = 9.222 × 10^{-6}

T_1 = 1,520 lb. m = .001689 t° = 100° F.

$a t^\circ$ = .000922

Item.	Function.	l = 200′	300′	400′
a	$-\frac{3}{8} l^2$	− 15,000	− 33,750	− 60,000
b	$w^2 l^2/24 \times T_1^2$	.000564	.001269	.002256
c	$b + a t^\circ - m$	− .000203	.000502	.001489
d	$a \times e$	3.015	− 16.9	− 89
e	$-3\ w\ l^4\ m/64\ T_1$	− 16.7	− 84	− 267
f	$e/2$	− 8.35	− 42	− 133.5
g	f^2	70	1,760	17,800
h	$-(d^3/27)$	− 1.17	17.8	26,600
j	$-f + \sqrt{g + h}$	16.63	84.1	333.5
k	$\sqrt[3]{j}$	2.55	4.38	6 94
n	$k - d/3K = S_2$	2.152	5.67	11.21
p	$T_2 = w\ l^2/8\ S_2$	465	398	184

With the aid of the above table, sag and tension curves can be drawn, and, to enable further tables to be made, Tables II, III, IV, and V are appended, giving the various constants required for h.d. solid and stranded copper conductors, stranded aluminium conductors, and steel-cored aluminium conductors to British Engineering Standards for e.h.p. lines only; that is, the column for w is calculated only for $\frac{3}{8}$-in. ice loading.

Table I shows only one application of the method; there are, of course, other conditions of the line which the engineer requires to know, and in all cases means alterations of the values of the constants set out at the top of Table I.

For example, to find the sags at any other temperature, it is only necessary to substitute the temperature rise in t° and modify at° accordingly and then proceed as before. Again, if the "cold sag" or minimum vertical sag is required, that is, when the conductor is at 22° F. with no ice load and no wind, $w = w$, $t^\circ = 0$ and therefore $at^\circ = 0$.

TABLE II.

SOLID COPPER CONDUCTORS ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight. Ice loaded conductor, W.	Max. working tension, T_1 lb.	$\frac{T}{AE} = m$
.01453	.056	.66	456	.00174
.01629	.0627	.669	508	.001736
.01697	.0654	.673	528	.00173
.01815	.0699	.679	561	.001718
.02061	.0794	.691	633	.0017
.02164	.0834	.696	662	.0017
.025	.0959	.713	757	.00168
.02545	.0981	.715	770	.001678
.02688	.1036	.723	810	.00167
.02926	.1128	.734	875	.00166
.03269	.1259	.751	971	.00165
.03731	.1399	.766	1,071	.00164
.05	.1922	.826	1,437	.001595
.0826	.3177	.963	2,244	.00151
.095	.3666	1.030	2,539	.00148
.109	.419	1.072	2,853	.00145
.126	.4843	1.142	3,230	.00142

TABLE III.

H.D. COPPER-STRANDED CONDUCTORS ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight, W.	Max. working tension, T_1.	$\frac{T_1}{AE} = m$
.025	.1	.752	791	.00176
.05	.2	.885	1,520	.001689
.075	.3	1.001	2,220	.001648
.1	.399	1.062	3,030	.001685
.125	.498	1.194	3,730	.001658
.15	.594	1.301	4,400	.00163
.175	.698	1.415	5,120	.001625
.2	.803	1.53	5,820	.001618
.225	.897	1.622	6,460	.001595
.25	.996	1.74	7,120	.001582
.3	1.215	1.982	8,970	.00166
.4	1.615	2.415	11,700	.001625
.5	2.006	2.84	14,310	.001592
.6	2.368	3.21	17,500	.00162
.75	2.996	3.91	21,750	.00161

TABLE IV.

STRANDED ALUMINIUM CONDUCTORS ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight, W.	Max. working tension, T_1.	$\frac{T_1}{AE} = m$
.02	.0392	.745	430	.001368
.025	.0491	.776	498	.001268
.03	.0584	.788	593	.001265
.04	.0793	.828	862	.001352
.05	.0976	.866	1,021	.00131
.06	.177	.905	1,184	.00125
.07	.1359	.940	1,368	.00125
.075	.1456	.955	1,464	.00125
.08	.1555	.972	1,533	.00123
.09	.1764	1.012	1,739	.001285
.10	.1963	1.044	1,895	.0012
.125	.2443	1.118	2,310	.001175
.15	.2919	1.195	2,702	.00115
.175	.3446	1.280	3,388	.001225
.20	.396	1.352	3,893	.001225
.225	.4396	1.418	4,235	.0012
.25	.4913	1.486	4,735	.0012
.30	.597	1.635	5,578	.001165
.35	.692	1.760	6,396	.001155
.40	.794	1.890	7,182	.001113
.45	.9006	2.030	8,304	.001155
.50	.9806	2.132	9,042	.001155
.60	1.163	2.360	10,401	.001115
.75	1.474	2.740	12,902	.00109

TABLE V.

STRANDED STEEL CORE ALUMINIUM ⅜ IN. ICE LOADING.

Area "A."	Weight per ft. w.	Resultant of wind and weight, W.	Max. working tension, T_1.	$\frac{T_1}{AE} = m$
.025	.0726	.784	1,090	.00181
.03	.0864	.810	1,273	.00178
.04	.115	.864	1,704	.001775
.05	.145	.914	2,053	.001715
.06	.173	.960	2,443	.001715
.07	.205	1.012	2,793	.00165
.075	.215	1.026	2,937	.00165
.08	.229	1.045	3,030	.001605
.09	.260	1.080	3,409	.0016
.1	.268	1.119	3,693	.001675
.125	.335	1.220	4,567	.00166
.15	.491	1.394	7,619	.001875
.175	.571	1.495	8,861	.001875
.2	.675	1.610	10,197	.001875
.225	.737	1.708	11,262	.00184
.25	.822	1.810	12,358	.00182
.30	1.006	2.040	15,118	.00182
.35	1.163	2.212	16,762	.00174
.40	1.332	2.42	18,536	.00168
.45	1.478	2.60	20,393	.00166
.50	1.347	2.495	18,165	.00164
.60	1.611	2.808	20,940	.001585
.75	2.015	3.272	25,519	.00154

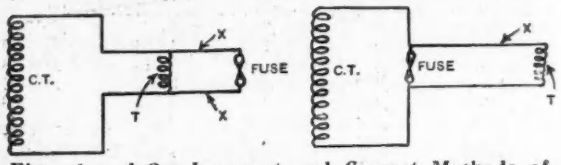
Some Distribution Troubles.

Faults Commonly Occurring on High- and Low-Voltage Networks.

By THOS. BARTON, B.Sc., A.M.I.E.E.

ALTHOUGH alternating current is coming to the fore as a means of distributing electricity, yet there are many d.c. supplies still in existence. A 3-wire d.c. supply is a general means of distribution, yet one of the troubles particularly peculiar to this means of supply is due to electric osmose.

Take the case of an underground sub-station in which the slate panels with the attendant fuses &c., mounted on



Figs. 1 and 2.—Incorrect and Correct Methods of Connecting Fuses.

angle or flat iron framework, are insulated at the base by porcelain insulators from, say, a glazed brick plinth. It will be observed some short while after installation that verdigris has collected on the base of the panel to which the negative main is connected. On touching the slate panels by hand one obtains an appreciable shock —an indication that the verdigris has caused considerable leakage. The glazed brick plinth also will be found to be considerably damp. The whole of the panels may be cleaned up, but the action still goes on—verdigris again develops.

In a three-wire system, the neutral being earthed, the negative is below earth potential. The electron leakage current therefore flows from the negative to earth. Whilst this stream of free electrons flows from negative to positive, displacement of collected H_2O apparently flows from positive to negative and, when it comes in conjunction with the copper and brass connections, causes verdigris. It should be noted, however, that this verdigris collects only on the base of the panel, where the latter is insulated from the brick plinth; at the top of the panel, where insulation occurs from a long angle iron, the effect is hardly noticeable.

A further trouble also applicable to a d.c. system is that of electrolysis. Here the cable which becomes positive with respect to earth suffers most. Consider

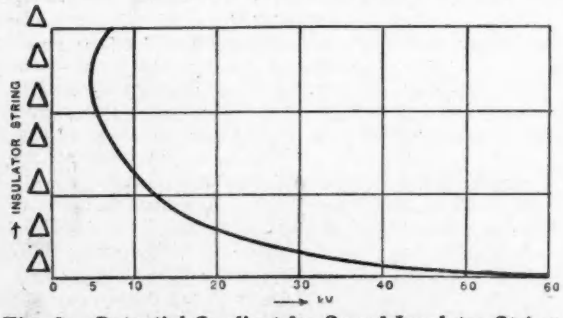


Fig. 3.—Potential Gradient for Sound Insulator String.

a paper lead-covered cable laid in ducts into an underground sub-station where water slowly trickles down the ducts. The electron leakage stream in the positive cable occurs from the water *via* the lead and paper, respectively, to the positive conductor. This leakage current, although initially small yet flowing constantly in the same direction, starts electrolytic action. The result is that the lead surface gradually takes up a white incrustation of lead carbonate; the lead sheath slowly thins until the water enters the papers, and finally the cable breaks down.

Consider next the case of an a.c. sub-station with six independent low-voltage feeders. The low-voltage side of the transformer is controlled by an automatic oil switch with C.T.-operated overload trip coils set at 5 amperes, but are also time limit fused. The six feeders are each controlled by porcelain handle type fuses in the phases with a link for the neutral.

Inadvertently, a nail is driven by a consumer through one of the six-feeder cables and the sub-station is shut down. Examination at the sub-station shows that none of the six-feeder fuses in any phase have blown—neither have the time limit fuses—consequently, until the offender admits his fault, one cannot diagnose on which phase or feeder the fault has developed.

Strictly speaking, the fuses in the feeder circuit should have blown. What actually has happened is that, due to the time lag of the feeder fuses (the time limit fuses being ineffective as stated below), the switch has operated on instantaneous overload. Time limit fuses become somewhat ineffective when connected up as fig. 1. Fig. 2 is the correct method of connection.

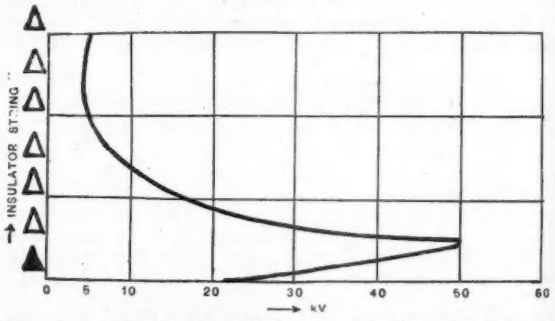


Fig. 4.—Potential Gradient when Faulty Insulator is at Earthed End.

It will be seen from fig. 1 that, if the resistance of the leads x, plus the resistance of the fuse contacts, plus the resistance of the fuse wire, is large compared to the impedance of the trip coil T, then the trip coil will operate before the time limit fuse blows. This fault arises through having long leads from the current transformer (CT) to the time limit fuse. The fuse contacts, too, should also be kept clean.

A trouble which arises due to paper lead-covered cables laid up a hill is that of compound running. This generally happens when, due to overloading of the cable in question, the impregnating compound becomes less viscous and slowly runs down hill, leaving the paper somewhat dry at the hill top. The cable then loses its flexibility and there is a tendency to crack the papers when a slight bend is required, with consequent breakdown of the cable.

This question of compound running, or bleeding, becomes more serious in super-voltage cables than in low-voltage cables. There are in general two methods of making up a paper-insulated cable. The first is to impregnate the papers and then wrap them on the conductor under compound, whilst the second method is to wrap the papers on the conductor first and then to vacuum-impregnate them. The former method enables a

more viscous compound to be used, and, consequently, bleeding starts at a higher temperature. The latter method necessitates a less viscous compound, and, consequently, its advantage is flexibility. Bleeding, however, should be avoided, as on super-voltage cables it causes the scattered air in the cable to collect in one location and form a void. At super-voltages the air in the void ionises and finally causes a breakdown of the cable.

Consider now the overhead transmission line. If we have a string of seven suspension insulators and, due to a surge or pressure rise, one of the seven breaks down, the line is not necessarily put out of action. Failure may be due to an insulator which, although having an initial puncture, might yet " heal up " and withstand a certain voltage again.

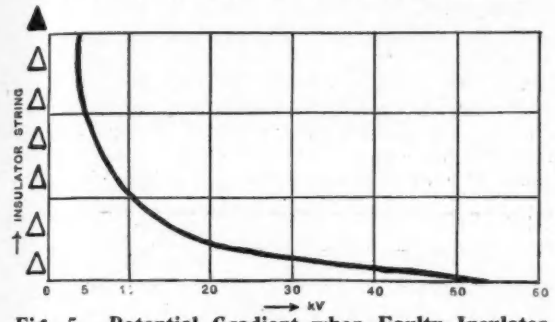


Fig. 5.—Potential Gradient when Faulty Insulator is Next to the Line.

The potential gradient is shown in fig. 3 for a sound string of insulators, whilst fig. 5 shows the faulty insulator located next to the line—the effect being to throw the stress upon that insulator next above the faulty one in the string.

The effect of a faulty insulator in the middle of the line is shown in fig. 6, and in fig. 4 the faulty insulator is located at the earthed end of the string. In all cases the line pressure was maintained at 100 kV and the gradient obtained by measuring the voltage across each insulator in turn.

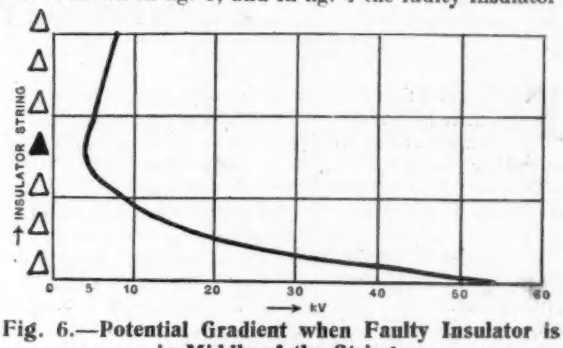


Fig. 6.—Potential Gradient when Faulty Insulator is in Middle of the String.

The Insurance of Employés.

A Large Electrical Company's Non-Contributory Scheme.

By BASIL BARHAM.

SOMETHING of an innovation in engineering works practice was made by one of the largest electrical manufacturing companies in existence some little time ago. It formulated, and put into practice a group life insurance plan for all its employés, including those engaged in different localities in erecting its manufactures and those employed in its branch and district offices. This insurance scheme applied to everyone in the employ of the company, no matter what their age, sex, or physical condition might be, and it appears that the plan has now been operating for a sufficient time to enable it to be said that it is a complete success.

Many of the benefits of works insurance will be obvious, but there is one which might be overlooked and which has a great bearing upon the relations between the firm and its workpeople and also upon production. This is the fact that every employé has his mind relieved as to the danger of financial trouble coming to his family in the event of his death. It may be urged that, to some extent, an insurance plan has a weakness here, in that it relieves the employé of any incentive to save and make provision for his dependants. It does not seem, however, as though the scheme referred to has that effect in practice. Another benefit which is felt entirely by the company and which, in itself, is worth some expenditure to obtain, is that the plan secures a marked degree of continuous service. We heard recently of the tendency of workpeople to change their situations for no apparent reason, and an instance was given of a man who had been in four or five different works in as many months. A man will, however, think twice before he leaves a works in which he is insured for a fairly large sum to go to his family in the event of death from any cause.

The amount of the insurance effected on the workpeople is £100 for one year's service, £150 for two, £200 for three, £250 for four and £300—which is the maximum—for five years' service. It appears that the life insurance company with which the policies have been arranged has waived the physical examination of the employé as a condition of the insurance, which is provided at the expense of the company. When the plan was more or less in an experimental state, the initial policies were for one year, but the success was such that some other arrangement will now be made. A question arose as to differentiation between those employés who had families and those who, in the event of death, would leave no dependants, and as a result it was decided that the latter should be insured for a nominal sum of £30, which would cover funeral expenses. Here, again, would appear to be a question of policy, bearing in mind that continuity of employment is to the advantage of the employer. The migratory habit is chiefly noticeable amongst unmarried employés, and the fact that an unmarried man is only insured for £30, as against £100 and upwards for a man with dependants, seems to place a premium on getting married and settling down. Naturally, the insurance ceases with regard to any employé when he leaves the service of the company, but an arrangement has been made with the insurance company by which insurance on a standard policy form at ordinary rates may be taken up by a man leaving his job, without any physical examination.

The company carrying out the plan has, roughly, 23,000 employés in one works, of whom over 10,000 have been regularly engaged for five years or over and so come within the scope of the maximum insurance. Of the remainder the great majority have already completed three years' service.

Our Foreign Electrical Trade.

The Origins of Imports and Destinations of Exports, with Figures for 1928 and Previous Years Compared.

THE annual statements of the overseas trade of the United Kingdom for 1928 have now made their somewhat belated appearance. They supplement the rather meagre information given in the monthly returns by furnishing, under a much more detailed classification, particulars of the countries of origin and destination, respectively, of imports and exports.

It may first be recalled that imports of machinery and of goods and apparatus in 1928 showed an advance in value in each of the two groups, the respective increases compared with 1927 being £126,000 and £455,000. On the other side of the account, exports of machinery showed an advance in weight of 396 tons, but a decrease in value of £7,000, thus breaking what had been a continuous rise in value for at least nine years, while exports of goods and apparatus decreased by the small sum of £250,000, this decline being spread fairly evenly throughout the whole group, although shipments of unspecified electrical goods and apparatus showed an advance of £200,000. The net result was a favourable

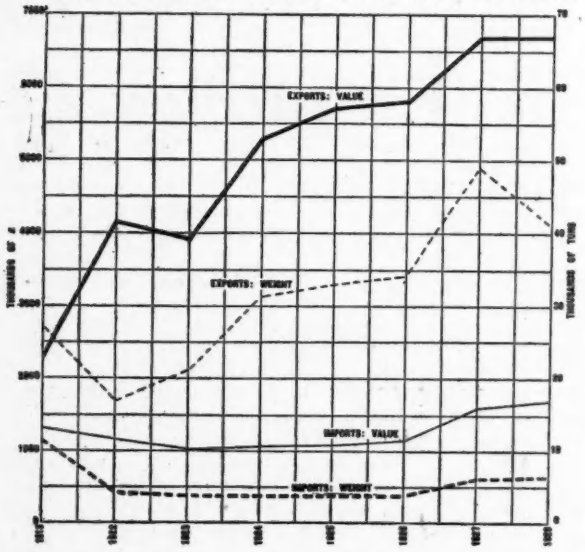


Fig. 1.—Imports and Exports of Electrical Machinery.

balance in the electrical trade generally of £11,900,000, only slightly less than in the previous year.

The general tendency over the past few years is shown graphically in figs. 1 and 2, the latter indicating at the same time the proportion of the total value of electrical goods and apparatus taken by British countries. It will be noticed that this proportion has shown a decline for three years running. Among foreign customers (other than those shown on charts 4 and 5) which helped to compensate for this decline, the United States is notable with purchases totalling £481,000 in value (largely submarine cable), Italy with £355,500, France with £250,000, Holland with £242,000 and Chile with £206,000. With regard to the trade in electrical machinery, it is found that the export of traction motors was lower than for at least five years, the total being £475,191, as compared with £495,159 in 1927, Empire markets having been accountable for the decline. South Africa's great activity in the traction field, which resulted in purchases between 1924 and 1927 averaging £150,000 yearly, seems to have come to a halt, for her total in 1928 was only £6,250. On the other hand, India's figure was £139,134, or twice the average of the previous four years. Japan was a better customer again with £67,000 against an average of under £40,000 during the previous six years. The trend of the traction motor trade over a period of years is illustrated in fig. 3,

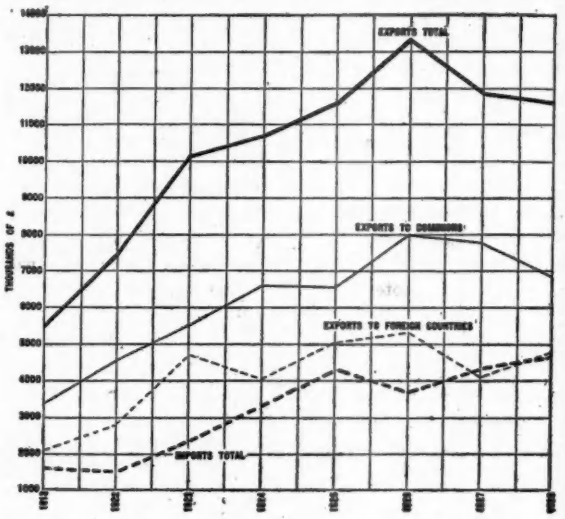


Fig. 2.—Imports and Exports of Electrical Goods and Apparatus.

on which are also shown the curves of lamp exports and imports.

While exports of a.c. motors were well maintained on the whole, this was due to foreign purchases (£304,786 against £190,183) and not to trade within the Empire, exports to the latter being only £474,102 as compared with £598,169 the previous year. Australia and the

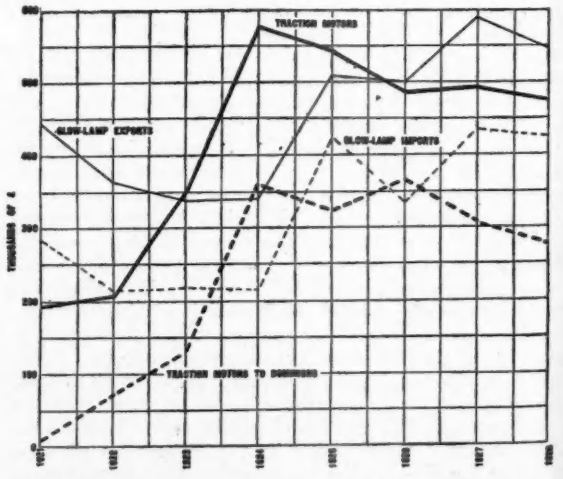


Fig. 3.—Exports of Lamps and Traction Motors.

Straits Settlements were the only Empire destinations for which a decline was not registered. To Argentina the value sent last year was £66,200, as against £22,860 in 1927. Exports of these motors to foreign destinations were in fact higher in value than in any year since 1921, although even in that "boom" year the weight was less than in 1928.

There was again a decline in the Empire's purchases of d.c. motors, *viz.*, to £257,606, from £472,000 in 1927 and £520,000 in 1926, small advances to Canada and the Straits Settlements being the only exceptions. There was also a decline on balance in the foreign trade, the Argentine Republic being a notable exception.

Of a.c. generators the total value exported (£847,000) was higher than ever recorded and nearly £300,000 above

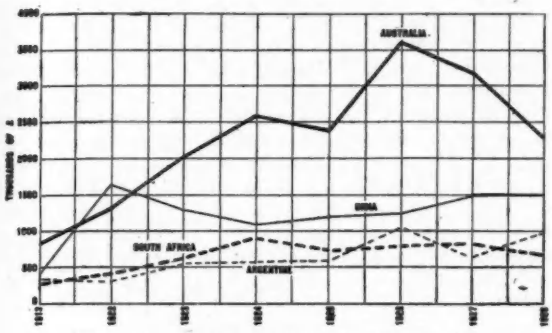


Fig. 4.—Destinations of Electrical Goods and Apparatus Exports.

the average of the previous six years. Among noteworthy items were exports to Russia (£67,000) and Argentina (£74,000). Empire trade was fairly well maintained, a noteworthy item being £69,000 to Canada, against an average of £33,000 only for the previous four years. Our trade in d.c. generators remained steady with regard to both value and destination.

In converting and transforming plant our export progress was only fairly well maintained. Nevertheless, of rotary plant, shipments last year reached £302,000, against £411,500 in value in 1927, whereas six years ago they were valued at less than £150,000. For static transformers the figure was £584,000, or about the same as in 1927, against only £259,000 in 1923. It is rather unsatisfactory to find, on the other hand, that imports of convertors and transformers rose last year to £153,000, as compared with only £43,000 in 1927. Exports of "electrical machinery not elsewhere specified" reached the high value of £1,113,000, or about the same as in 1927. Of the grand total of exports of electrical machinery, *viz.*, £6,690,000, the value consigned to British countries was £4,390,000, and that to foreign destinations £2,300,000, thus following the recent trend,

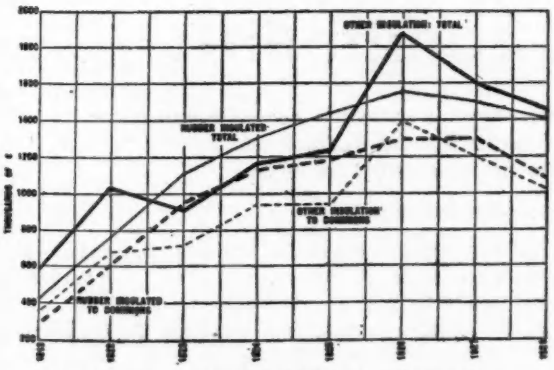


Fig. 6.—Exports of Cable (not Telegraph or Telephone).

for in 1926 and 1927 the Empire was more than twice as valuable a customer as the rest of the world. Its relative share in the electrical goods and apparatus trade is shown in fig. 2, as already pointed out. Although there was but a small decrease in the total value of the exports of electrical goods and apparatus, there was a loss of trade with British countries amounting to £966,000, as compared with 1927. The British Empire was still far and away a more important buyer as a whole than foreign countries of lamps, batteries, and accumulators, lighting accessories, instruments, and all descriptions of cables, except submarine, but not of radio and other telephone and telegraph apparatus.

Looking further into the destination of our export trade in goods and apparatus, it is found that compared with 1927, Argentina has been a more active purchaser of telegraph and telephone apparatus; Chile of telegraph and telephone material and radio instruments; France of submarine cables, radio instruments, and

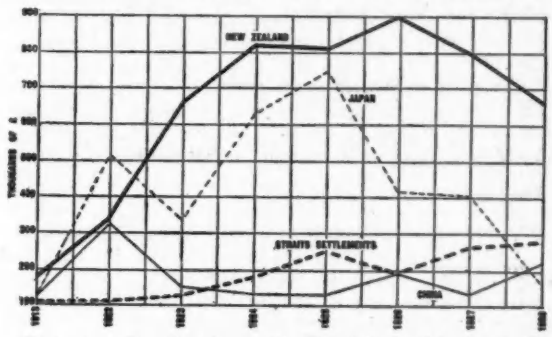


Fig. 5.—Destinations of Electrical Goods and Apparatus Exports.

lighting fittings; and Italy of telegraph and telephone apparatus and also of a large quantity of material under the heading "unspecified." The Egyptian market continues to grow. It is noteworthy that Japanese trade suffered a further decline, the total value of her purchases of electrical goods and apparatus being but £161,000 last year, as compared with an average for the four preceding years of £550,000.

Figs. 6 and 7 show how exports in the cable group have progressed. They account for over 35 per cent. of the total exports of electrical material other than machinery. Of rubber-insulated cable, other than telegraph and telephone, about one third of the value which was sent to British countries again went to Australia, and the same remark applies to cable (not telegraph or telephone) with insulation other than rubber. There was a fairly large shipment (£390,000) in 1928 of submarine cable to the United States, while for telegraph

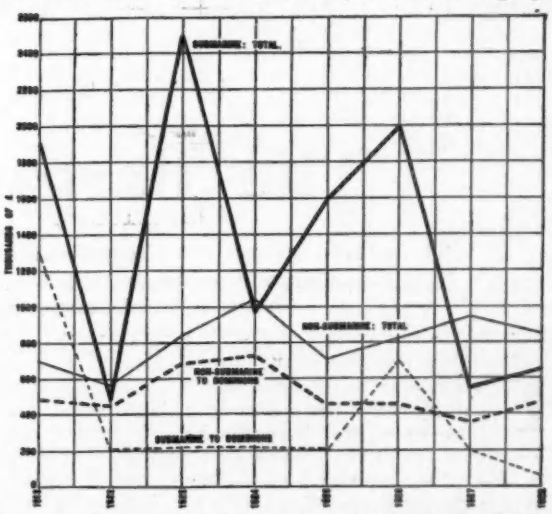


Fig. 7.—Exports of Telegraph and Telephone Cable.

and telephone cable, other than submarine, Egypt and South America figured as large customers, although the Empire accounted for nearly half the trade.

Overseas business in radio apparatus has been barely maintained. Exports of such material (not including valves) reached £950,000 in value in 1928, as compared with £1,000,546 in 1927 and about £100,000 more than that figure in the two preceding years. The main destinations of this material were:—British countries £335,000 (including Australia, £95,000, India, £58,000, South Africa, £43,000, and Irish Free State £39,000),

and foreign countries £614,000 (including Holland, £109,000, France, £73,000, Japan, £38,000, and Argentina, £25,000). Of other telegraph and telephone instruments Australia again figured largely as a purchaser with £400,000, but was excelled by Argentina with £426,000 (against £211,000 in the previous year). On the whole the British group showed a distinct falling-off, which was balanced by a rise from £648,000 in 1927, to £948,000 in 1928 in the foreign trade. Exports of radio valves have been checked, the value last year having been only £180,000, as compared with £213,000 in 1927, with Australia the best customer (£56,000) and then South Africa (£14,500).

The chief countries from which our imports of electrical goods and apparatus and machinery are derived are shown, respectively, in figs. 8 and 9. Reckoning goods and apparatus as well as machinery, Germany's

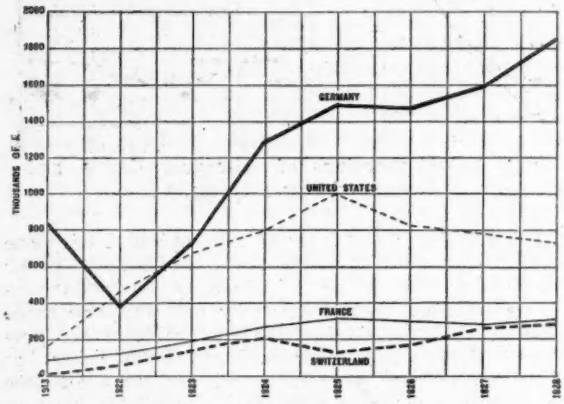


Fig. 8.—Origin of Electrical Goods and Apparatus Imports.

total contribution to our imports was £2,034,000, as compared with £1,802,000 in 1927; that of the United States £1,409,000, as against £1,427,000; that of Switzerland £364,000, and that of Sweden £275,000. With regard to d.c. motors, which, apart from vacuum cleaners, still constitute the largest item specified amongst imports of electrical machinery, there was a small decrease from £210,400 in 1927 to £182,000 in 1928. The bulk of these machines again came from the United States (£124,000, against £144,000); Germany's share was valued at £18,000 (against £15,000), while Sweden, Holland, Belgium, Switzerland and France made contributions valued at between £5,000 and £7,000.

Imports of a.c. motors were also rather less in both value and weight than in 1927, *viz.*, 995 tons valued at £147,600, against 1,065 tons valued at £162,800 in 1927, but it should be recalled that in the preceding year only 583 tons valued at £88,000 were imported. Of the 1928 total, £71,500 is credited to the United States, £44,000 to Sweden, and £11,000 (against £8,000 in 1927) to Germany.

In the import trade in generators there was an increase on the whole. Of a.c. machines, it is true, the value was only £11,900 against £16,900 in the previous year and no less than £64,500 in 1926, but of d.c. generators there was a greater value (£54,000) imported than in any year since 1922, and a greater weight than ever before recorded. The United States accounted for £20,761, and Switzerland £19,880.

Imports of vacuum cleaners, for which a new heading in the trade returns was raised in 1927, had a total value

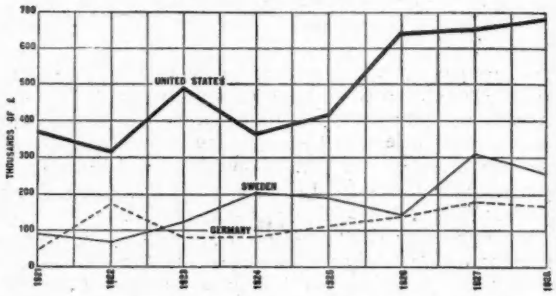


Fig. 9.—Origin of Electrical Machinery Imports.

of £656,000, including £114,000 from Sweden, £176,000 from the United States, and £232,000 from Canada. Our exports of vacuum cleaners are comparatively negligible—£32,000 last year, compared with £43,000 in 1927. In the goods and apparatus group there were particularly noteworthy increases in lighting accessories (including switches) and fittings, and batteries, an advance of about £140,000 being shown in the former group.

The Barton Judgment.

The author reviews the circumstances of the recent Farnworth *versus* Manchester Corporation action, sets out the reasons for the decision of the House of Lords, and comments on an existing anomaly.

By J. W. THOMAS, LL.B., B.Sc., A.M.I.E.E.

IT is not easy to condense into a small compass the main points of the judgment of the House of Lords in the recent case of Farnworth *v.* Manchester Corporation,* but it is desirable that some attempt should be made for the benefit of supply engineers who are naturally very much interested in it. There were really three points to be decided, two of them matters of law and the other a matter of fact: (1) Was the Manchester Corporation Act, 1914, which authorised the Corporation to acquire land and erect the Barton generating station a special Act within the meaning of the Electric Lighting (Clauses) Act, 1899? (2) If not a special Act did the Act exempt the Corporation from liability for nuisance provided there was no negligence? (3) Assuming that the Corporation had such statutory immunity from liability for nuisance had it in doing what the Legislature had authorised done all that was reasonably necessary in order to avoid a nuisance?

* Elec. Rev., December 6th, p. 1023.

It may be noted that if the answer to the first question had been in the affirmative or the answer to the second question in the negative it would have settled the matter, as the nuisance having been admitted the Corporation would have been liable. The determination of these legal questions depended upon what was the true construction of the 1914 Act, and that they were by no means free from difficulty, is quite clear from a perusal of the judgment. In order to understand the issues involved it is desirable to give a short account of previous legislation and of the law with regard to nuisance.

Prior to 1899 it was customary to insert in every Provisional Order entitling an undertaker to supply electricity in a certain area a clause to the effect that "nothing in this Order shall exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them." This clause has since become

known as the Nuisance Clause, and the effect of its inclusion is to render the undertaker liable to proceedings for any nuisance caused in carrying on an undertaking.

The Manchester Order of 1890, which is the foundation of the Corporation's electricity supply powers, contains a nuisance clause, and thus the Corporation is liable for nuisance even though caused without negligence in the management of the stations within its area of supply. In other words, its liability for nuisance is precisely that under the common law, and it is only necessary to prove that the nuisance exists for liability to arise. The fact that a station has been built under the authority of Parliament and that it is worked without negligence (if that be the case) does not when there is a nuisance clause in the Act or Order relieve an undertaker from paying compensation for damage in the event of a nuisance arising. It may be explained at this point that a public body is no more authorised to create a nuisance, unless compensation is provided, than a private body. There are cases, however, such as with the railways, in which statutory powers are granted to bodies to create a nuisance without being liable provided that they can prove that the nuisance is necessarily incidental to the carrying on of their activities. A body has only this authority, however, when the language in the statute from which it derives its powers is sufficiently clear to authorise the nuisance. Where, on the other hand, the Act definitely provides that the body shall not be exonerated from liability for nuisance it is in the same position as any private body under the common law.

As Provisional Orders became more frequent it was thought desirable to group the usual clauses into one Act and provide that they should be incorporated in every subsequent Provisional Order or Special Act unless expressly excluded or varied. Accordingly, in 1899 the Electric Lighting (Clauses) Act was passed, and it enacted that the provisions contained in the schedule to that Act should be incorporated with, and form part of, every Provisional Order and Special Act made after the commencement of the Act save in so far as they were expressly varied or excepted by the Order or Act. The term "Special Act" was defined in the 1899 Act as "any Act passed after the commencement of this Act authorising the supply of electricity for any public or private purpose within any area." Amongst the provisions in the schedule was the nuisance clause. Thus in every Provisional Order and Special Act made since the 1899 Act the nuisance clause has been deemed to be incorporated unless expressly excluded or varied. Subsequent Acts have not changed this procedure as they are to be construed together. The Electric Lighting Act of 1909 provided that the Board of Trade (now the Electricity Commissioners) could by Provisional Order authorise any local authority, company, or person to acquire compulsorily and to use for the purpose of a generating station any land specified in the Order within or without the area of supply. Since the passing of that Act many undertakers have obtained special statutory powers by Private Act authorising them to acquire land and to erect and work generating stations. The nuisance clause has been expressly excluded from some of these Acts, thus making the undertakers liable only to proceedings for nuisance in respect of such stations in the event of negligence being proved against them. If the nuisance clause is incorporated, as it sometimes is, then they are liable for nuisance caused without negligence. Assuming that the clause is neither incorporated nor expressly excluded the question whether the undertaker is liable for nuisance without negligence will depend upon whether the particular Act is to be regarded as a Special Act within the meaning of the Electric Lighting (Clauses) Act, 1899. This was the first point to be decided in the Barton case. The powers to acquire the land and to erect the station at Barton were obtained by the Manchester Corporation Act, 1914. This was an "omnibus" Act which conferred other powers on the Corporation. The main purport and effect of the Act so far as it related to the generation of electricity was to empower the Corporation to acquire compulsorily a site outside its area of supply for the purposes of a generating station, to erect and work a station on that site and to construct and maintain the necessary mains to enable the electricity generated to be brought into the area of supply. Opinion was divided both in the Court of Appeal and in the House of Lords as to whether the Act conformed with the definition of a Special Act contained in the Clauses Act, 1899, but a majority in both held that it did not. In deciding that the Act was not a special one Viscount Sumner and Lord Blanesburgh expressed the view that the Act was not one authorising the supply of electricity within any area because the Corporation by previous Provisional Orders already had been authorised to supply in its area. Lord Dunedin, however, differed from this opinion, and pointed out the dangers that were likely to arise if this view were adopted. It would mean that municipalities knowing the law would avoid Provisional Orders when arranging for a generating station outside their own boundaries and endeavour to get their authority in an "omnibus" Act which would not be a Special Act containing a nuisance clause. Thus they would avoid the liabilities which a nuisance clause would otherwise impose upon them. By getting evidence to prove that they knew of no remedy to prevent the nuisance undertakers could practically throw the onus of finding one on the plaintiff. If they were under a nuisance clause they would have to exert themselves to find a remedy, and the onus of proving that there was none would be upon them. So far as the Manchester Corporation was concerned, had the portions in the 1914 Act relating to the Barton generating station been embodied in a Provisional Order, instead of being in an "omnibus" Act, the nuisance clause would no doubt have been incorporated and the Corporation would then have been made liable to the same extent in respect of Barton as it was in respect of its other generating stations.

Having ruled by a majority that the 1914 Act was not a Special Act, the next point for determination was whether it was the intention of the Legislature under the Act to take away the common law rights of individuals who might be injuriously affected by the working of the station. It is well known that the Legislature has frequently invested public undertakings with powers the exercise of which, although interfering with the private rights of individuals, are of advantage to the general public. Such an intention to take away those rights, however, will not be imputed to the Legislature, and the burden lies upon those who seek to establish such an intention to show that it appears either by express words or by necessary implication. In one class of case the powers conferred by statute are of a purely permissive character and only authorise the doing of a thing provided it can be done without interfering with the private rights of individuals. In the other class there is an intention to interfere with private rights but with the proviso that if the interference can be avoided by a reasonable exercise of the statutory powers it is actionable negligence on the part of the undertaker not to make such a reasonable exercise. The law with regard to this class was laid down by Lord Blackburn in the case of Geddis in which he said that "it is now thoroughly well established that no action will lie for doing that which the Legislature has authorised if it be done without negligence although it does occasion damage to anyone." The House of Lords decided in favour of the proposition that the Barton station fell within the second class. Had the contrary view prevailed the Corporation would have been held liable seeing that nuisance had been admitted. The next point therefore for their Lordships' consideration was whether the Corporation had used all due and reasonable means and precautions to avoid a nuisance. It is significant that their Lordships were unanimous in finding that the Corporation had not proved that the nuisance was necessarily indispensable to the running of the station. Like the Court of Appeal they were not satisfied that all reasonable steps had been taken to explore the causes of, and remedies for, the damage or that all reasonable precautions had been adopted to prevent it. They therefore confirmed the decision of the Court of Appeal and awarded damages to the plaintiff, but agreed that the suspension of the injunction should continue for one year from the date of the Order of the House. During the next twelve

months, therefore, the Corporation will have an opportunity of exhausting all reasonable modes of preventing the nuisance, and will be at liberty to apply to the King's Bench Division to dissolve the injunction on establishing that it has done so and that it is replacing the existing methods by the most effective method which it has discovered. The criterion as laid down by Lord Dunedin is "not what is theoretically possible, but what is possible according to the state of scientific knowledge at the time, having also in view a certain commonsense appreciation, which cannot be rigidly defined, of practical feasibility in view of situation and expense."

There can be no doubt that the effect of the Barton decision will be to stimulate the efforts which are now being made to deal with the emission of sulphur fumes. Whilst few are likely to agree with the strictures passed on the Corporation for what was described as its callous indifference in the construction of the station, one must admit that the question of liability for nuisance has not been treated by engineers with the seriousness which it deserves. The issue raised is obviously a grave one from the point of view of those who are affected by the sulphur nuisance, and they are entitled to demand either some compensation for the damage done or the satisfaction of knowing that everything possible has been done to prevent it.

But if engineers are open to criticism, the lawyers are in no better plight. They are responsible, at least to some extent, for the present confused and uncertain state of the law. To the layman it must seem illogical that there should be such uncertainty with regard to the liability for nuisance and that some power stations which happen to have been erected under private Acts should enjoy certain advantages as to liability for nuisance whilst others erected under a Provisional Order do not. If generating stations are to be authorised by Parliament they should be put upon the same basis as far as their statutory powers are concerned, and if one might venture to suggest it, it should be similar to that of the railways, so as to subject them to no more liability than is laid down in the case of Geddis.

The Barton case will have served a useful purpose if it directs attention to the desirability of the Legislature, when granting powers under private Acts, of stating in express and uniform terms the extent of the liability for nuisance incurred in the exercise of them.

Electricity for the Home.

Examples of All-electric Houses; Descriptive Notes and Cost Data.

A Demonstration All-Electric House.

A feature of the business-getting programme adopted by the WEST GLOUCESTERSHIRE POWER CO., LTD., for domestic electrification is a demonstration all-electric house, the following particulars and illustrations, figs. 1 and 2, of which we have received from Mr. Harry Ellis, M.I.E.E., the general manager and chief engineer of the company. Some idea of how the purpose of the installation is being fulfilled may be gathered from the fact that during the months of September and October last 500 people visited the house.

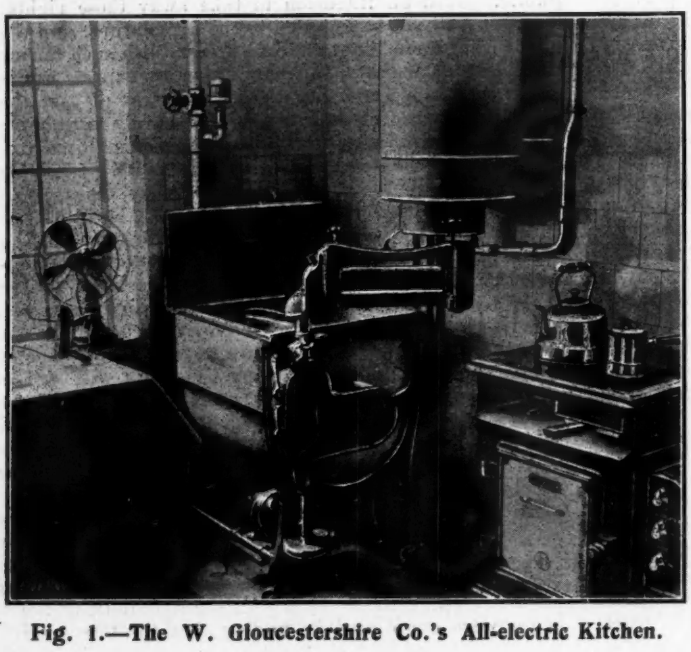


Fig. 1.—The W. Gloucestershire Co.'s All-electric Kitchen.

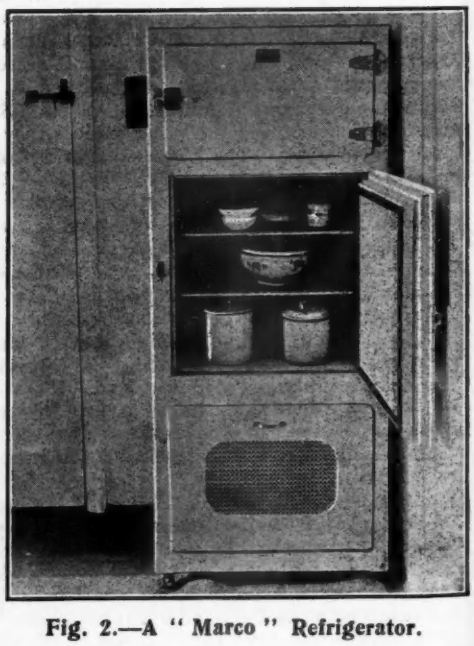


Fig. 2.—A "Marco" Refrigerator.

The house is one of average size, and has three bedrooms, two reception rooms, and a kitchen and bathroom. It is fully equipped throughout with electrical apparatus for lighting, heating, cooking and water heating, and there are many auxiliary appliances. The dining room is equipped with a "Goodwood" central lighting fitting (Gregson Mfg. Co.), a G.E.C. table lamp and shade, a 1-kW Belling radiator, a Metro-Vick coffee percolator, a Premier warming plate, and a Metro-Vick toaster. Two 5-A outlets serve this apartment. Heating in the sitting room is provided by a 3-kW "Magicoal" fire (Berry's Electric), while light is provided by a totally-enclosed central unit and a standard lamp, both of Metro-Vick manufacture. A "Premier" electric kettle, a M.V. vacuum cleaner, and a G.E.C. all-mains radio set constitute the remainder of the electrical equipment in this room, in which there are four outlets.

A very comprehensive range of electrical appliances is in use in the kitchen, a view of which is depicted in fig. 1. The cooker is of the "Jackson" No. 20B type, with the oven-interior, racks, and panelled door vitreously enamelled. The kettle (3¼-pints) is fitted with a safety device and is of Jackson manufacture, as also are the 10-gal. storage heater and a 10-gal. wash boiler, which is fitted with three-heat control and a "Perco" wash device. The "Magnet" washing machine, with "Wizard" attachments, and a "Locomotive" washer are both demonstrated at different periods. A "Marco" No. 159 refrigerator, fig. 2, and a "Frigidaire" No. D.5 model are also shown alternatively. The lighting is provided by a M.V. central ceiling fitting, and the heating by a 1-kW G.E.C. radiator. A further essential kitchen utensil is an "Xcel" electric iron. A M.V. oscillating fan is of special interest in that it is governed by a "Satchwell" thermostat in order to demonstrate this method of control. The bedrooms are fully equipped electrically; each has a two-light rise and fall lighting pendant over the dressing table, and mirror brackets; "Litlux" bed lights and a table lamp are also on show. A 1-kW, a 750-W, and 600-W (bowl fire) radiators serve for heating the three bedrooms.

The entrance, hall, landing and bathroom are all artistically lighted, and the hall is equipped with "Unity" tubular heaters.

The demonstration described was arranged by the Company's Sales Department, under the direction of Mr. Parker (sales engineer) and Mr. Reynolds (consumers' engineer).

Stoke-on-Trent.

The residential areas of the City of Stoke-on-Trent and the surrounding pottery towns are essentially working class districts, and the Corporation's efforts to popularise the domestic use of electricity are therefore of considerable interest.

The main features of the Corporation's scheme for the domestic development of electricity are all-electric houses, a low multi-part tariff, showrooms, and a wide range of publicity matter attractively written.

Realising that to increase the domestic consumption of electricity it was necessary in the first place to teach the residents the many uses to which it can be applied, the Corporation, early in 1927, adopted the practical method of opening eight all-electric houses for public inspection, and later in the same year these were let to tenants, who have since expressed their great appreciation of the convenience of electricity. Four of these houses have one fire place and chimney each, but the others depend entirely upon electricity for all domestic purposes. The record of consumption and cost of electrical energy in these houses over a period of two years provides an excellent example of the cheapness of electricity in the area when used for all purposes. During the first year of tenancy, the total consumption in the eight houses was as follows:—Lighting, 1,279 kWh; radiators and cooking, 35,522 kWh; water heating, 23,879 kWh: total, 60,680 kWh. The total cost was £203, the average cost per house per week 9s. 8d., and the average cost per kWh 0.80d. For the second year the figures were even more favourable, the total consumption increasing to 71,174 kWh, largely due to the increased use of radiators and cookers, whilst the total cost was reduced to £189, or an average per house per week of 9s. 1d. and an average cost per kWh of 0.64d. These houses proved so successful that another eight were inaugurated in October last. In addition to the figures given above, those supplied by Mr. C. H. Yeaman, city electrical engineer, relating to his own house are interesting. For the year ended with the last September quarter the total consumption was 12,365 kWh at a total cost of £30 16s. 4d., and an average price per kWh of 0.508d.

The foregoing results have been obtained by the operation of the following attractive multipart tariff: a fixed quarterly charge (which includes meter rent) of 5s. per living room, and a consumption charge of 1d. per kWh for the first 240 kWh per quarter, and ⅜d. per kWh for all electricity consumed in excess of that amount.

Full advantage is taken of the electricity showrooms to propagate the electrical idea and, in addition to frequent demonstrations, the local branches of the E.A.W. and the E.C.A. hold their meetings on the premises. Cordial relations are maintained with the local electrical contractors by handing over to them a portion of the difference between the trade and retail prices of domestic appliances sold from the showrooms.

When to these activities the holding of electrical exhibitions is added, it will be seen that not only does the Corporation offer electricity for domestic use at a price within the reach of the working man, but it also ensures that the advantages to be derived from its use are constantly before the eyes of prospective consumers.

Fig. 3.—Stoke Corporation's All-Electric Houses.

Electricity, Gas, and Coal Costs.

The following particulars which we have received from Mr. Eustace R. Conder, A.M.I.E.E., of Liverpool, will no doubt be useful and of interest, as the case is probably typical of the majority of electrical domestic consumers at present, in that electricity and coal are both used:—

"In response to your request in your leader of October 4th for 'reliable information as to the actual costs in respect of all-electric houses,' I have pleasure in enclosing tabulated costs for my own house during the past four years. Previous to September 30th, 1927, I used coal fires in the kitchen and living room, and gas for lighting and cooking, and a gas fire in a room which is used during part of the day as an office. This gas fire could not be used in any other room. As from September 30th, 1927, I have used coal fires in the kitchen and living room, and electricity for lighting and cooking, and a 3-kW radiator in the room which is used during part of the day as an office. This radiator has been sometimes used in other rooms.

"My household consists of my wife and three children, ages 18, 20 and 25 years, respectively, and myself."

The costs referred to are as follows:—

Tabulated Costs.

Year ended September 30th, 1926 :—

	£	s.	d.
184.3 therms at 8d.	6	2	11
Gas meter rent		2	8
Gas cooker rent		6	0
Total cost of gas	6	11	7
Coal	11	11	8
Total cost of gas and coal	£18	3	3

Note.—This included the period of the coal strike when economy was exercised in the use of coal and gas.

Year ended September 30th, 1927 :—

	£	s.	d.
218 therms at 9d.	8	2	10
Gas meter rent		2	8
Gas cooker rent		6	0
Total cost of gas	8	11	6
Coal	12	11	5
Total cost of gas and coal	£21	2	11

Note.—After the coal strike the cost of gas was increased.

Year ended September 30th, 1928 :—

	£	s.	d.
1,594 units at 0.5d. per unit ...	3	6	6
20 per cent. of £21 ratable value	4	4	0
Electricity consumed cost 1.13d. per unit	7	10	6
Electricity meter rent		10	0
Electric cooker rent	1	0	0
Total cost of electricity	9	0	6
Coal	12	0	0
Total cost of electricity and coal ...	£21	0	6

Year ended September 30th, 1929 :—

	£	s.	d.
1,703 units at 0.5d. per unit ...	3	11	0
20 per cent. of £22 ratable value	4	8	0
Electricity consumed cost 1.12d. per unit	7	19	0
Electricity meter rent		10	0
Electric cooker rent	1	0	0
Total cost of electricity	9	9	0
Coal	10	2	9
Total cost of electricity and coal ...	£19	11	9

Note.—The ratable value was increased to £22. The 3-kW radiator and an additional 1½-kW radiator were used during the evenings of spring and autumn instead of coal fires. Hence the increased consumption of electricity and decreased consumption of coal.

Collieries and the Grid.

In a recent discussion at the Sheffield University on electricity and collieries, Prof. Douglas criticised the grid system, under which, he said, colliery owners would be at a serious disadvantage by having to take their supplies for power purposes from the super-stations of the Central Electricity Board, whereas by making their own they could ensure cheaper supplies. Mr. Wm. Hay, managing director of the Thorncliffe Collieries, declared that the grid system would seriously increase the cost of electricity to colliery companies, and it could not be expected that those responsible for working collieries would consent to a system which would compel them to pay more for their electricity. While at the present time they were prevented from using their surplus power, they were expected to turn over that surplus to the super-power stations, who would reap a profit from such surplus and use the power in any way they wished.

Reviews.

Elements of Electrical Engineering. Second edition. By Arthur L. Cook, B.S., M.S. Pp. xi+584; figs. 379. London: Chapman & Hall, Ltd. Price 20s. net.

This book has been thoroughly revised for the second edition to incorporate an account of the developments which have taken place in the electrical industry since its first appearance in 1924. A new chapter on the electron tube has been added, and the sections of the work dealing with d.c. machines and rectifying apparatus have been considerably amplified. A new set of problems has been substituted for those in the first edition.

The book is intended to outline an elementary course in electrical engineering for junior students and also for those specialising in other branches of engineering. A knowledge of the rudiments of electricity and magnetism is assumed, as well as an acquaintance with elementary mathematics. The mathematics in the book are generally very simple, and the calculus does not appear to be used at all. Although the work is generally concerned with elementary electrical engineering theory, there is a fair amount of descriptive matter illustrative of the principles treated. As this descriptive matter relates to current American practice, its value to the English student is somewhat discounted.

The first portion of the book deals with electric and magnet circuits, and here the principles of direct current working and of electromagnetic relations are dealt with in the conventional manner. A chapter in this section deals simply with electrostatic principles.

A considerable space is devoted in Part II to direct-current machinery. The construction, operation and characteristics of dynamos are dealt with in considerable machinery, and the author has evidently been at pains to make clear to his readers the principles underlying the actions of the machines of this class. His explanation of the building up of the voltage of a self-excited machine would, however, have been much clearer had the well-known graphical construction of resistance lines intersecting the saturation curve been utilised. The characteristics of d.c. motors are explained in considerable detail, and there are in this part useful chapters on commutation of armature reaction and the determination of the efficiency of d.c. machinery, starting gear, and three-wire balancing machines. A short chapter is devoted to storage batteries, and the concluding chapter in this part deals with d.c. distributing systems and wiring installations.

The third part of the book deals with the principles of alternating currents and with calculations relating thereto. Here, again, we have the detailed and careful treatment which should be useful to the student of non-mathematical tastes who is commencing to work on this subject. There is little novelty in the author's methods, but it is somewhat surprising to see how little reference is made to the subject of power factor which usually looms large in works of this character. We have in this part a very clear account of the phase relationships of current and voltage in polyphase circuits. There are a few references to a.c. instruments in this part, but this apparatus is only briefly noticed in passing, and there is no separate chapter or section devoted to it.

The concluding part of the book deals with a.c. machinery, and considers, in order, transformers, induction motors, synchronous generators, motors and convertors. The chapter on the induction motor would have been considerably clearer had the elementary form of the circle diagram been used for the purpose of illustration. The chapters on current rectifiers and single-phase motors are too scanty to be of much use, whilst, in the chapter on switching and protective devices there is not, as would be expected, any reference to the systems of automatic protection which now plays so important a part in alternating current engineering. The treatment of a.c. transmission lines is brief, but useful, whilst the notes on illumination and lighting fittings and on the application of d.c. and a.c. motors will be acceptable to the student.

The book is provided with a good index, and there is an extensive collection of problems for solution. The utility of this collection is, we consider, much impaired by the fact that the answers to the numerical examples are not given. The work is, however, generally conventional in character and differs very little from the numerous books on the elements of electricity which have been published in America in recent years. Whilst it will probably be useful to those who are not specialising in electrical engineering, it can hardly be considered as an ideal textbook for those intending to make a serious study of this subject.

Elements of Radio Communication. By John H. Morecroft. Pp. x+269; figs. 170. London: Chapman & Hall, Ltd. Price 15s. net.

Mr. Morecroft's large textbook on the "Principles of Radio Communication" is in extensive use as a standard treatise in the United States and is well-known to students and radio engineers in this country, so much so that a new book by this author is bound to be received with interest in both countries.

The present book, however, is intended for the use of students, as opposed to those who are already versed in the

subject; in fact, the scope of the book is admirably summed up in the first word of its title, the "Elements." It may be considered as an introductory volume to the more ambitious "Principles," which has already been reviewed in this journal, and the general scheme followed is the same, *viz.*, a review of the general theory of alternating currents, followed by the applications of this theory to the art of radio communication, with, however, special emphasis on its applications to broadcasting, one whole chapter out of seven being devoted to broadcast receiving sets. The book, in fact, is more an introduction to radio broadcast practice than to radio communication in its wider sense, and this is specifically implied in the preface, where the author mentions that "a large proportion of students are naturally interested in broadcasting." Many of such students will obviously have only an elementary knowledge of mathematics, and the author is careful to avoid anything more advanced than simple algebraic formulæ.

The subject is dealt with accurately and concisely, but, in covering so much ground in so small a space, a student who is trying to understand the subject without outside assistance is certain to find that difficulties arise from the matter appearing at times to be disjointed. With the help of an instructor these difficulties would disappear, and the book would be found to form a sound introduction to the theory and practice of radio communication. A set of problems is given for each chapter, and this should prove of great value to the student.

Very little is said about commercial radio practice, but many aspects of broadcasting in the United States are mentioned which will interest people on this side, such as the fact that advertisers may pay as much as 5,000 dollars an hour for the use of a station, as well as paying for the artists engaged. The historical aspect is not touched upon, but in this connection we are surprised to see that the name of the inventor of the audion is always spelt Deforest.

The whole production of the book is first-class, including what is often overlooked, the placing of diagrams exactly where the text requires them for easy reference.

Electromagnetic Problems in Electrical Engineering. By B. HAGUE. Pp. xiv+359; figs. 116. London: Oxford University Press, (Humphrey Milford). Price 30s. net.

It has been our privilege on other occasions to review earlier works by Dr. Hague, and in so doing to play no small part in introducing to electrical students and engineers the investigations of one of our most brilliant workers in the field of pure and applied electricity and magnetism. The present volume adds to our indebtedness to the author, and it constitutes an exceptionally able and orderly treatment of essentially basic theories, and, in spite of its relatively modest compass, we think Dr. Hague's book will undoubtedly rank as a classic on the subject. The work is concerned with the investigation of the magnetic field in simple types of dynamo-electric machines and allied apparatus, including transformers, and, being addressed to two distinct classes of reader, is divided into two corresponding parts. The first, which deals with the general theory of the subject of electromagnetism, is designed, as might be supposed, for the use of advanced students of electrical engineering and others who require an elementary discussion of the principles of electromagnetism so far as they bear upon the physical theory of electrical machinery and apparatus. While attention is directed to scalar potential and flux conceptions, the idea of vector potential has also been introduced, and the need for this method of treatment in connection with electromagnetic problems is indicated, its properties being also demonstrated in a way designed to appeal to engineers. In the chapter on mechanical forces on linear conductors the author gives a particularly interesting comparison of the method usually adopted for calculating the forces of currents in the magnetic field with Maxwell's ether stress theory. The second part is offered as a link between the ordinary textbooks of electricity and magnetism and those which discuss the design and operation of electrical machinery chiefly from the practical engineering standpoint. Thus Part II chiefly appeals to practicing design engineers. In this part the principles enumerated in the theories embodied in Part I are applied to the calculation of certain practical engineering problems. Particular attention is directed to the work of Rogowski and of Roth on the leakage field in transformers, and to Strutt's solution for the magnetic field of thick conductors with various forms of cross section.

Chapter I is a general introduction to the subject. Chapter II has for its basis a study of the elementary physical theory and definitions of the electric field of a current. Chapter III deals with the elementary mathematical theory of the magnetic field of a current which embraces geometrical properties of potential and curl fields, two dimensional electromagnetic fields in free space and within a conductor, vector potential and boundary conditions in the electromagnetic field. Chapter IV discusses the general theory of electromagnetic fields with iron boundaries and the method of images. The general theory of the mechanical forces on linear conductors is established in Chapter V, which covers considerations of mechanical force on a circuit and Maxwell's theory of the force on a circuit.

The second part of the book, which deals with the applications of the principles laid down in the foregoing chapters, opens in Chapter VI with a treatment of the magnetic field of linear currents or of current sheets in an air gap with plane iron boundaries when the iron has infinite permeability. Chapter VII deals with electromagnetic forces on linear conductors in an air gap with plane iron boundaries when the iron has finite permeability. Chapter VIII discusses the magnetic field of linear currents or current sheets in an air gap with concentric circular cylindrical iron boundaries of infinite permeability.

In Chapter IX the author passes on to the logical treatment of the electromagnetic force on linear conductors in an air gap with concentric circular cylindrical iron boundaries of infinite permeability. Chapter X passes on to the general case of which Chapter VIII was a particular example. Chapter XI derives the general expressions for the electromagnetic force in non-salient pole machines, and Chapter XII deals with the magnetic field of straight conductors having various shapes of cross sections, and it also contains a very interesting summary of the methods of treatment of the leakage field in shell type and core type transformers, having cylindrical and sandwich windings. The treatment is based largely upon those of Rogowski and Roth.

Chapter XIII, which is the last in the book, deals with the mechanical forces on simple circuits and within conductors. The volume is completed by appendices on the method of drawing the field distribution diagrams and the representation of electromagnetic fields by solid models.

The author presupposes the reader to possess a good general knowledge of electricity and magnetism, a thorough familiarity with the principles of electrical engineering, a fair knowledge of differential and integral calculus, an understanding of the use of Fourier's series, and an elementary acquaintance with the simpler parts of vector analysis. We hardly think a work requiring such a standard of mental equipment can accurately be described as elementary, and no doubt the author's own technical attainments have given him a somewhat mistaken sense of relative values in this direction. Thus, while there may be a considerable number of students and engineers who will agree with the author's classification of the volume, the large majority, we feel, will regard it as occupying a much more exalted sphere.

It will be gathered from what has been said that the book deals principally with rotating electrical machinery, and in this connection we invite the author's future consideration of a more extensive treatment of the electromagnetic phenomena arising in transformers and kindred static apparatus, such as induction regulators and iron-cored choking coils. May we hope this is foreshadowed by the reference in the preface to a future work on the complete theory of electromagnetic machinery which will embody the graphical and experimental methods of dealing with field distribution problems mentioned by the author?

The book is admirably produced in a style which leaves nothing to be desired, while the illustrations are excellent. The price charged for the volume, while high, is not unduly so for the standard of the contents and of the production.

S. Austen Stigant.

Electric Street Lighting. By C. J. STAHL. Pp. xi+288; figs. 128. London: Chapman & Hall, Ltd. Price 17s. 6d.

Most of the up-to-date literature on this subject is contained in the journals of scientific societies, and a practical book dealing with Electric Street Lighting represents a valuable contribution to the book shelves of those engaged in administering public services.

The author writes with the authority of many years practical experience in the subject, and, while its presentation has the exclusive background of American experience, there is much in the volume that can be put into practice by street lighting engineers in this country.

The author has not attempted (who can?) to give dogmatic prescriptions for street lighting design based upon absolute scientific procedure, but he has given empirical rules which represent a compromise of the many important factors involved in street lighting to ensure general satisfaction.

He follows usual American practice in giving lumens per linear foot of street, pointing out that horizontal illumination alone is not the only important factor of good street lighting, and that this can be said of almost any application of light.

The chapters dealing with city zoning for street lighting, circuit arrangements including series lighting, and architectural aspects of street lighting are particularly thoughtful and valuable. Some of the illustrations of decorative street lighting units used in other countries should form valuable examples to civic authorities in this country.

The chapters dealing with "Light, Cause, and Effect," "Light Measurement," and "Principles of Light Control" attempt to deal in a short space with matters that are already sufficiently well covered in other manuals, and in any further edition one would suggest that this section be revised or eliminated.

There is also evidence of careless editing, as it is difficult to refer to tables mentioned in the text. This is particularly true on page 222.

To summarise: the book is, on the whole, well produced and represents an important contribution to the subject.

D

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The "Electrical Review" Index.

The Index to Vol. CV (for the half year ending December 31st, 1929) will be published shortly, and we shall be glad to receive the names and addresses of those who require it (free of charge) for binding purposes or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.

Electrical Trades Commercial Travellers' Association.

A successful dinner and dance of the Electrical Trades Commercial Travellers' Association was held at the Hotel Cecil on December 11th. The chairman of the Association, Mr. R. W. Whitley, presided over a gathering of about 170 members and guests. In a brief speech—the only one of the evening—Mr. Whitley extended a warm welcome to the guests and thanked the members for their excellent support of the function. A bouquet of pink carnations was presented to Mrs. Whitley. Almost everyone took part in the dancing which followed the dinner, while an interlude of community singing was heartily enjoyed. A set of lancers was received with an enthusiasm in no way marred by a somewhat imperfect knowledge of the steps. Mr. J. W. Ward is to be congratulated on carrying out so efficiently the arrangements for the evening.

An Echo of the General Strike.

In our last issue we reported the dismissal from the Hull Tramways Department of a number of men who joined the Department during the general strike of 1926. The matter was raised in the House of Commons on December 12th by Sir A. L. Ward a Hull member, who asked the Minister of Labour what action she proposed to take. Miss Bondfield replied that the matter was solely one for the decision of the City Council. Sir Arthur Steel-Maitland asked if she would not get into touch with the parties concerned in order to remedy any victimisation. Miss Bondfield asked for notice of the question.

It is reported that the men involved are raising a lefence fund to enable them to fight the case.

Electricity in Refrigeration.

Mr. R. C. Hawkins, Area Officer of the British Electrical Development Association, gave an address on December 10th to members of the North-Western branch of the British Association of Refrigeration at Liverpool on the electric lighting of cold stores. Some interesting points were raised in the discussion. Commander Owen said that in the wiring of cold chambers trouble had been experienced owing to the condensation that took place. Lead-covered cable had been used alternatively to conduit, but in that case oxidisation was liable to take place, leaving a crumbling mass of white lead and creating the danger of short circuits. Many tests had been made at cold stores of different methods of wiring and eventually a simple form of vulcanised rubber covered cable had been proved satisfactory.

The Demand for Factory Accommodation.

In a recent letter, Messrs. LEOPOLD FARMER & SONS, surveyors, auctioneers and valuers, 46, Gresham Street, E.C.2 state:—"The year 1929 has proved in many ways an extraordinary and, for some periods, a difficult one. At the beginning business was as flourishing as in the year 1928. New industrial companies were being formed, combines of existing businesses were taking place, and factory premises throughout the country were being keenly sought after. With the advent of the General Election, however, business began to drop away. New public issues practically ceased, and manufacturers were biding their time before seeking new or additional factories. Subsequently, what with one disastrous event after another in the financial world, business became somewhat restricted. At the same time there appears now to be a revival of interest in the manufacturing world with regard to the acquisition of premises. Prices of factories have remained practically the same as in the year 1928, and there is very little diminution in value where a factory is of modern construction. In fact, there appears to be a special demand, which is difficult to meet, for this class of factory. Where no such property is available there is a tendency for manufacturers to build to their own requirements, and there are many areas within a radius of 30 or 40 miles of London, where considerable building operations are taking place for the erection of factories, embracing all the modern requirements of the up-to-date manufacturer. During the course of the year our Valuation Department has been kept very busy; at all times valuations of assets are necessary for various purposes.

"One of the great legislative features of this year, and for which manufacturers are particularly thankful, is the De-Rating Bill. It has given relief to the producer which, in many instances was much needed. It has assisted him in reducing to a great extent his overhead charges, and provided additional working capital for the greater employment of labour and a larger output of the finished product. It has also had the effect of producing a demand for factories in neighbourhoods that have been neglected, in consequence of the high rates peculiar to the district, so that from everybody's point of view this excellent piece of legislation meets with well merited thanks and unstinted appreciation."

The British Exhibition in Buenos Aires.

We are informed that the Prince of Wales has agreed to become patron of the British Empire Trade Exhibition, which is to be held in Buenos Aires from February 18th to April 2nd, 1931. A booklet is now available from the London office of the Exhibition, 5, Parliament Mansions, Orchard Street, S.W.1. (Telephone: Victoria 0877), giving full particulars of the arrangements. The charges for space and stands are set out, and it is emphasised that no profit is to be made from the Exhibition by the organisers. Other matters dealt with are: Services and supplies, Customs, shipping, lighting and power, retail sales, and representation. An architect's drawing which is reproduced promises a very large, well-laid-out display. There are also key plans of the ten pavilions.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during November:—

	Nov., 1929.	Inc. or dec. as compared with Nov. 1928.	Eleven months, 1929. Inc. or dec.
Imports.	£	£	£
Electrical goods & apparatus	736,482	+212,687	+1,542,068
Machinery	1,531,320	+109,721	+2,012,069
(Including electrical machinery)	161,190	+ 25,202	+ 129,426
Exports.			
Electrical goods & apparatus	1,252,983	+255,576	+1,296,852
Machinery	5,078,911	+427,925	+ 700,591
(Including electrical machinery)	574,115	– 78,125	– 372,211
Re-exports.			
Electrical goods & apparatus	25,141	+ 6,033	+ 46,212
Machinery	143,286	+ 734	+ 5,661
(Including electrical machinery)	13,390	– 4,928	– 21,431

The American General Electric in Styria.

According to the *Grazer Tageblatt*, the General Electric Company of America will participate in the exploitation of the beryl deposits recently discovered near Koeflach, in Styria, and will spend $1,000,000 for the purpose. It is also reported that the company's works in Dakota will be abandoned, as the Koeflach Beryl Works are sufficient for the requirements of the whole world.—*Reuter* (Vienna).

Calendars and Diaries.

The 1930 calendar sent us by Messrs. THOMAS BOLTON AND SONS, LTD., Widnes, is of a serviceable type with large monthly sheets bearing illustrations of the company's products.

The 1930 calendar of Messrs. ERNEST F. MOY, LTD., Greenland Place, Camden Town, N.W.1, is a neat desk pattern with monthly date cards.

Mr. CHRISTOPHER WADE has sent us a charming calendar with monthly slips, illustrating in beautiful colours an Eastern scene, entitled "A City of Splendour."

A desk calendar with daily slips has been received from Messrs. B. S. & W. WHITELEY, LTD., Pool Paper Mills, Pool-in-Wharfedale.

Unemployment.

There was an increase of 17,442 in the number of registered unemployed during the week ended December 2nd. At that date the total was 1,302,900, as compared with 1,285,458 on November 25th, and 1,350,806 on December 3rd, 1928.

A Bilingual "Osram" Sign.

The accompanying views show a large sign in operation in India. It flashes different advertisements at ten-second intervals, and is visible the whole length of Chowringhee, an important Calcutta thoroughfare. The sign is legible at a distance of three-quarters of a mile and is fitted with no fewer than 5,400 "Osram" lamps. There is a lead and return for each lamp, and a large quantity of wire and cable of "Pirelli-

"Osram Lamps" in English and Bengali.

General" manufacture is employed in the installation. As the pictures show, the word "Osram" is flashed out alternately in English and Bengali, and the natives are now as familiar with the meaning of this word as are the numerous English and European residents.

The E.D.A. January Programme.

The Outlet Campaign and the advocacy of the use of miscellaneous appliances form the subjects of the January activities of the British Electrical Development Association. The special window display, in arranging which E.D.A. offers assistance to dealers, is illustrated herewith. The principal expense connected with the display material (apart from the appliances) is the cost of the silver "cubes," but these have already appeared in previous displays, and most retailers who follow E.D.A.'s suggestions should have them in their possession. An attractive background is provided by orange and white crêpe paper radiating from one of the special Campaign showcards.

The national advertising introduces the lady of the showcard and the slogan "Plug in to Comfort." The importance of adequate electrical facilities in the home is stressed in an effective manner. The block for use in local newspapers is of a similar character, and the phrase, "Have your Electrical Installation Brought up to Date," figures boldly in the announcement. The same advertisement is available in the form of a lantern slide for kinema and theatre use. The programme sets out a number of appropriate E.D.A. publications and their moderate prices. Another feature of the programme is a poster calendar for 1930. Particulars are also given of the January Salesmanship Conferences, and there are some notes by the Director.

Great Britain's Radio Exports.

During October last the value of radio apparatus exported from this country was £84,546, including valves valued at £14,917. Italy was the leading importer, having taken goods valued at £9,774 (valves £1,143); Holland was second with £8,950 (valves £214). Other leading customers were the Irish Free State £6,250 (valves £1,531); India, £6,078 (valves £832); Australia, £5,994 (valves £2,164); the Union of South Africa, £4,281 (valves £1,115); and Belgium, £3,706 (valves £458).

New French Companies.

The following companies have recently been established in France: The Société Electro Métallurgique du Bourget, Bourget (Seine), capital 100,000 fr.; La Société de Traction et de l'Electricité, Paris, 260,000,000 fr., to acquire, and amalgamate the businesses of the Société d'Electricité et de Traction, and the Compagnie Auxiliare d'Electricité et de Transports; and La Société Union Electrique de la Région Vendéenne, Paris (9, Rue Louis Murat), 2,000,000 fr.

South American Trade.

Diplomatic representatives of Brazil, Argentina, and Uruguay were entertained at dinner by Mr. A. Henderson, Foreign Secretary, on December 11th, and Lord d'Abernon and members of the recent Economic Mission to South America were also present.

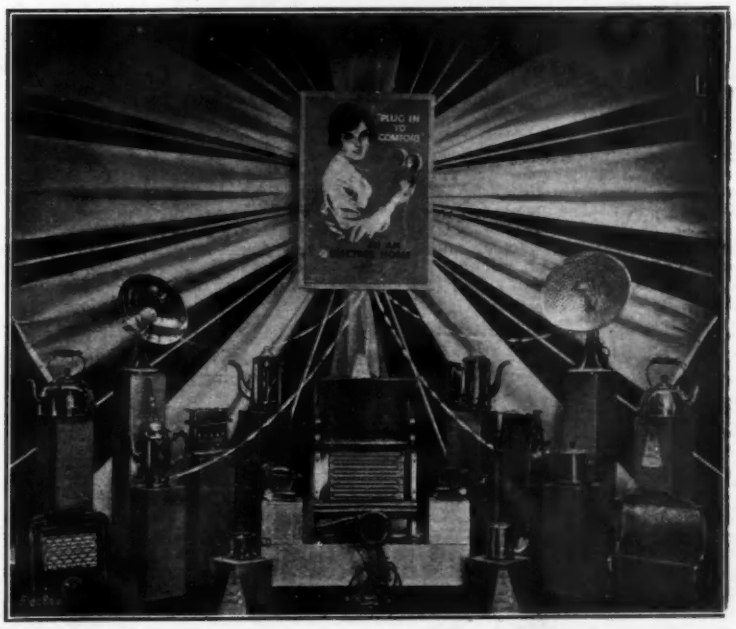
Mr. W. Graham, President of the Board of Trade, said that since the war the United States had stepped into the position in South American trade which was formerly held by Great Britain. Our immediate task was to make every effort to regain that position, and he hoped that the result of the Mission's visit would be to bring the South American countries into closer touch with us.

The Brazilian Ambassador said that the Mission had greatly impressed his countrymen as a proof of Great Britain's desire to strengthen the bonds uniting the two countries. He hoped that in the near future Great Britain would be taking greater quantities of Brazilian products. Brazil offered a vast market to British manufacturers, whose workmanship was fully recognised. He felt sure that they would find greater outlets for their goods as a result of the Mission's work, combined with a close study of the language and tastes of the Brazilian consumer.

Lord d'Abernon spoke of the high esteem which Great Britain enjoyed in South America, but said that British trade was not commensurate with the depth of that regard. In comparison with the possibilities the present development was merely moderate. The development of foreign trade was not necessarily detrimental to the Imperial conception. Both foreign and Empire trade were necessary to British prosperity. It was possible, however, that we might use the argument of Imperial trade in our negotiations with foreign countries so as to secure reciprocity in our dealings with them. He hoped that Sir Malcolm Robertson's optimistic view of the probable results of the Commission's work would be fully justified.

The Brussels Wireless Exhibition.

The British Commercial Secretary at Brussels informs the Department of Overseas Trade that the Annual Radio Salon which took place in that city from October 12th to 21st,



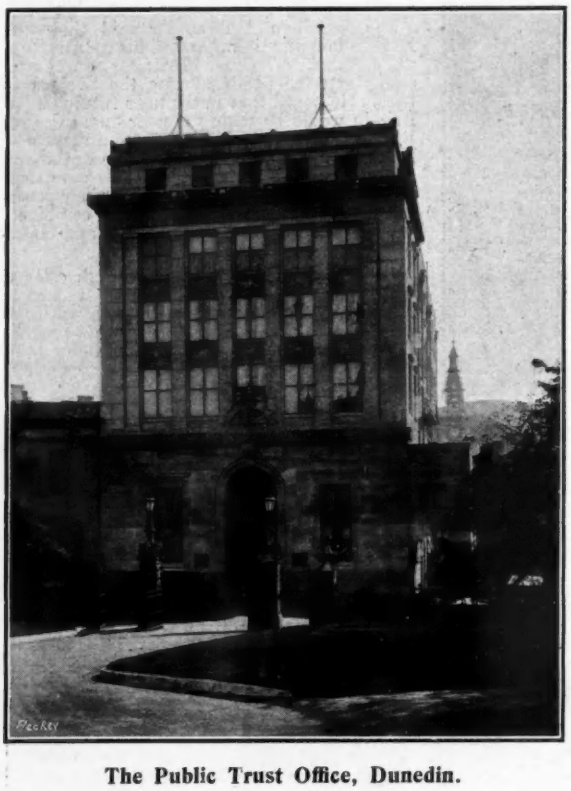
The E.D.A. January Display.

was well attended by the public. Material of British manufacture was well represented. In fact, the general impression gained at the show was that this year British participation "swamped" both the local and foreign elements, alike in range and quality. Many of the latest specialities from the recent Radio Exhibition at Olympia, including a varied range of electrically-operated wireless-gramophone sets built into handsome cabinets, electrical gramophone amplifiers, &c.,

attracted marked attention. Accessories, such as loud-speakers, valves, &c., of British origin, were also much in evidence. Agents exhibited material from France and Germany at a few stands, and offered payment by instalment terms to buyers. The few existing Belgian manufacturers of importance showed a varied range of goods at prices considerably below the level of those of foreign competitors.

A Special New Zealand Installation.

The accompanying illustration shows the Public Trust Office, Dunedin, New Zealand, which has recently been wired. This electrical installation is the first of its kind in Otago on a complete draw-in system dispensing with inspection fittings on the concealed parts. All the wires are stranded and are run in galvanised conduit sunk into the concrete; inspection fittings could not be used as the floors were cemented over and the ceilings plastered. The pipes were bent and the looping done at the ceiling outlets, special cast steel boxes being made locally



The Public Trust Office, Dunedin.

as the Government regulations in New Zealand require that a wire may be easily replaced at any time. The building created so much local interest that the public was admitted during the opening week. The installation was carried out by the Dunedin branch of Turnbull & Jones, Ltd. All the cables were of Henley's make, and Henley ruptor switches and fuses were employed on the main circuits. We are indebted to W. T. Henley's Telegraph Works Co., Ltd., for the photograph.

The Christmas Holidays.

The works and offices of Brookhirst Switchgear, Ltd., will be closed from noon December 24th to the morning of December 27th.

The Jackson Electric Stove Co., Ltd., states that its offices will be closed from Tuesday evening, December 24th, until Saturday morning, December 28th.

The works of Messrs. Reavell & Co., Ltd., will be closed from the afternoon of December 24th until the morning of December 30th.

The Midland Electric Manufacturing Co., Ltd., informs us that its stores will be closed for stocktaking from noon, December 24th, to the morning of January 1st.

Bankruptcy Proceedings.

L. W. Westbury, 383, Birmingham Road, Walsall, lately trading as L. W. Westbury & Co., and also as the Walsall Radio Co., 146, Lichfield Street, Walsall, wireless goods dealer. —The public examination of this debtor was held on December 12th at the Court House, Walsall, when a statement of affairs was filed showing liabilities of £1,308, and a deficiency of £1,289. The examination was adjourned for closing.

J. Wyndham (Wyndham's Wireless & General Manufacturing Co.), 114, Tottenham Court Road, W.1.—Receiving order made December 5th on creditor's petition. First meeting yesterday (Thursday) at Bankruptcy Buildings, Carey Street, W.C.2; public examination, January 21st, at the same address.

J. J. Brown, wireless agent, 79, Fairholm Road, Benwell, Newcastle-upon-Tyne.—Receiving order made December 5th on a creditor's petition. First meeting December 20th, at the Official Receiver's office, 81, St. Mary's Place, Newcastle-on-Tyne. Public examination, January 8th, at the Court House, Newcastle-on-Tyne.

F. V. Lambert, electrical contractor, 27, Parrock Street, Gravesend.—Bankrupt's discharge suspended until January 13th, 1930.

K. P. J. Jolivard (K. Jolivard & Co.), electrical engineer, 66, Victoria Street, S.W.—First and final dividend of 4d. in the £, payable at Carey Street, W.C.

E. C. Jenkins, wireless dealer, 11, Brook Road, Ashley Road, Bristol.—Trustee, Mr. H. Aston, Official Receiver, 26, Baldwin Street, Bristol, released December 3rd, 1929.

R. H. Warmington, electrical engineer and contractor, 26, Stackpool Road, Southville.—Trustee, Mr. Hashton, Official Receiver, 26, Baldwin Street, Bristol, released December 3rd, 1929.

R. Yeend (Central Electricity Works), electrician, 19, Victoria Avenue, Lynn Road, Wisbech.—Trustee, Mr. F. H. Langmond, Official Receiver, 41, Sidney Street, Cambridge, released December 3rd, 1929.

Company Liquidations.

Super Electric Heaters, Ltd.—A meeting of members is called for January 8th at 3, Warwick Passage, Corporation Street, Birmingham, to hear an account of the winding up from the Liquidator, Mr. F. E. Bendall.

Kidderminster & Stourport Electric Tramway Co.—Winding up voluntarily. Liquidators, Mr. H. G. W. Teverson, Mucklow's Hill, Halesowen, and Mr. C. D. Borer, 88, Kingsway, W.C.

For Sale.

Offers are invited for the purchase of surplus plant from Frindsbury power station. Particulars and specifications from Messrs. W. E. Fischer, Ltd., 8, Water Lane, E.C.3. Walton-upon-Thames Urban District Council has a number of second-hand d.c. meters for disposal. (See our advertisement pages to-day.)

New Catalogues and Lists.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—A special number of the house organ of the Australasian Philips Company, issued to celebrate the jubilee of the electric lamp. It contains many interesting illustrated notes.

Electrical Equipment & Carbon Co., Ltd., Bank Buildings, 107-111, New Oxford Street, W.C.1.—List No. 26/29 showing various types of connectors and terminals for overhead lines. Illustrated and priced. Also a leaflet referring to the "Mignon" hand drilling machine.

Messrs Capel & Co., Ltd., XL Engine Works, St. Peter's Street, Colchester.—A number of illustrated pamphlets drawing attention to "XL" vertical engines and lighting sets, and "Excelite" belt-driven generating sets.

Messrs. Heyes & Co., Ltd., Water-Heyes Electrical Works, Wigan.—An illustrated and priced catalogue of "Wigan" signalling apparatus (electrical).

Safac Accumulator Co., Ltd., 36, Raymouth Road, Bermondsey, S.E.16.—A folder giving capacities, dimensions, and prices of "Safac" non-sulphating accumulators.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 428 describing the "Seelco" wiring system. Illustrated and priced.

Messrs. Ferranti, Ltd., Hollinwood, Lancs.—A descriptive catalogue (pp. 507) for 1929-30, detailing the company's products. It is divided into six sections covering house service meters, non-magnetic cast iron, transformers, instruments, radio apparatus and heating equipment. In addition to a detailed index it also contains a general index to catalogue sections, and is fully illustrated. The volume is bound in strong leatherette and has the company's name inscribed in gilt letters on the cover.

Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, W.C.2.—A leaflet drawing attention to the company's type "K" cabinet loud-speaker.

Messrs. Richardsons, Westgarth & Co., Ltd., Hartlepool. —A well produced and illustrated brochure describing steam turbines constructed by the company to the Brown Boveri Company's designs.

Messrs. Mayall & Co., Ltd., 61, Moor Street, Birmingham. —An illustrated price list of electrical accessories.

Messrs. Drake & Gorham Wholesale, Ltd., 67, Long Acre, W.C.2.—Pamphlet No. 471, containing illustrations, prices, and brief details of wireless receivers, loud-speakers, h.t. batteries, l.t. accumulators, &c.

Frigidaire, Ltd., Frigidaire House, Chapter Street, Westminster, S.W.1.—A well-produced brochure drawing attention to "Delco-Light" sets for private house lighting and "Delco-Light" deep well pumps. Dimensions, capacities and prices are given, and some excellent illustrations in colour are also included.

Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Mile End, Glasgow.—Pamphlet No. 258/1, giving illustrated particulars of the company's flameproof controllers.

Trade Announcements.

The Universal Housing Co., Ltd., which has a department for electrical installation work, has opened premises in Peel Road, Douglas, Isle of Man.

The works of Messrs. CAPEL & Co., LTD., have been removed from 168, Dalston Lane, E.8, to the "XL" Engine Works, Colchester.

The telephone numbers of the HART MANUFACTURING Co., 76, Rochester Row, S.W.1, are now Victoria 2087 and 2088. To cope with greatly increased business, additional stock rooms have been acquired, situated above the premises in Rochester Row.

The WHITWORTH ELECTRIC LAMP Co., LTD., is acquiring, from January 1st, the wholesale distributing business of Dormor & Co., 217, Old Christchurch Road, Lansdowne, Bournemouth. Mr. O. A. Plimsaul, the present manager, will remain in charge. The company is also forming a subsidiary—Whitworth Electrical Repairs, Ltd.—to deal with all classes of repairs to electrical appliances.

The large new chromium plating works which have been established by the NORTHERN CHROMIUM Co., LTD., in Skinnerburn Road, Newcastle-on-Tyne, were officially opened on December 18th, by Sir Andrew Duncan, Chairman of the Central Electricity Board.

Recent Contracts.

It was announced last week that the Egyptian Government had awarded a contract valued at £67,000 for the extension of the Gabbari (Alexandria) railway power station to the Metropolitan-Cammell Carriage, Wagon & Finance Co., Ltd.

Important orders received by Hart Accumulator Co., Ltd., recently include one for two batteries, each consisting of 25 "S.T.F. 67" cells, having capacity of 9.693 Ah, to be installed in the new Whitehall telephone exchange.

Book Notice.

"Loaded Submarine Telephone and Telegraph Cables." Pp. III+60; figs. 23. Woolwich: Siemens Brothers & Co., Ltd.—Submarine cables already play an invaluable part in international communication, but until the advent in recent years of "loaded" cables the service was restricted, so far as telephone traffic was concerned, to short distances. The artificial introduction of inductance to the cables has not only enabled the speed of telegraph transmission to be greatly increased, but has also achieved a result even more far-reaching and significant, *viz.*, the transmission of the human voice over far greater distances than was possible with unloaded cables. Already, the distances spanned by submarine telephone cables are quite considerable, and it requires but little imagination to foresee the time when all the continents will be interlinked by a submarine telephone network. In providing such facilities electrical science may claim to have made another valuable contribution to the utilities of life. The book (it is well worthy of a better title than pamphlet 200A) which we have the pleasure of perusing, gives an account of the "loaded" submarine telephone and telegraph cables manufactured, and in most cases also laid, by Messrs. Siemens Brothers, who are amongst the pioneers in this branch of the electrical industry. The opening chapter deals with "loading" in a general way, while successive chapters contain illustrated descriptions, supplemented by copious tabular matter, of coil-loaded and continuously-loaded telephone cables insulated with gutta-percha and paper, respectively, and continuously-loaded gutta-percha-insulated telegraph cables. A brief mathematical treatise on telephone and telegraph transmission is given in an appendix.

Association of Ex-Siemens' Men.

A smoking concert will be held by the Association at Gatti's Restaurant, Strand, W.C.2, on January 14th. Tickets are 3s. each and guests will be welcomed. Mr. J. Snow Huddleston, M.I.E.E., Dagenham Dock, Essex, is the hon. secretary, and will be pleased to give full particulars of the Association to any intending members.

Social Events.

The annual staff dinner of Messrs. Tamplin & Makovski, Ltd., was held recently at the Warwick Hotel, Redhill, Mr. A. W. Makovski (chairman of the company) presiding. In responding to the toast of "The Directors," Mr. Makovski said that to combat the intense competition which existed no firm could live unless its standard of work was high.

Henley's Dramatic Club has added yet another play to its long list of successful productions. This time it was Galsworthy's "The Skin Game," which was given at the Cripplegate Theatre on December 16th. The production reached a very high standard, and the acting of the whole company was first class. Particular mention may be made of the performance of Mr. W. G. Turner as Hillcrist (a country gentleman), and Miss Hilda Snedden as his wife. Mr. H. Stanley's interpretation of Hornblower (a *nouveau riche*) was a *tour-de-force*, and among the ladies Miss Fay Smith, as Chloe, and Miss Hilda Starbuck, as Jill (Hillcrist's daughter) gave spirited performances. The theatre was crowded, and the reception accorded the company was enthusiastic.

A Turbo-Alternator Development.

For many years Messrs. RICHARDSONS, WESTGARTH & Co., LTD., have built steam turbines at their Hartlepool works to the designs of Messrs. Brown, Boveri. They have recently completed shops for the manufacture of alternators as well, also to Brown, Boveri designs. The new shops are equipped for the production of alternators up to the maximum size and work has just commenced on the first three commercial machines for the Hartley Main Colliery Co., Ltd. These comprise one 3,000-kW and two 2,000-kW machines, 6,600 V, 40 cycles, operating at 2,400 r.p.m.

"Metrovick" Apprentices' Revue.

The M-V Apprentice Association gave performances of its annual revue, entitled the "Collaptimists," at the M-V Club, Stretford, from December 11th to 14th. There was a distinctly professional touch in the rapidity with which the items followed each other; not one empty minute occurred from the beginning to the interval, and from the interval to the end.

"Metrovick" Apprentices in Revue.

Some of the sketches, and those not the least interesting, were written, besides being produced and acted, by members of the Association. The dancing was distinctly vivacious, and the final item, in which four youths dressed and made up as pretty girls went through quite a lengthy stage dance with male partners, was thoroughly enjoyable; the verve and precision were excellent. There were full and appreciative houses all through. Mr. G. E. Bailey (director) and Mrs. Bailey were present on the first night.

The British Industries Fair.

The following is a list of exhibitors in the wireless section of the British Industries Fair, which is to be held in the new and reconstructed Olympia, London, from February 17th to 28th next:—

Amplifiers, Ltd.
Bakelite, Ltd.
Cole, E. K., Ltd.
Cook's Wireless Co., Ltd
Darwins, Ltd.
Eastick, J. J., & Sons.
Ever-Ready Co. (Gt. Britain), Ltd.
Formo Co. (Arthur Preen, Ltd.),
Halcyon Wireless Co., Ltd.
Igranic Electric Co., Ltd.
Indurite Agency.
Laker, John & James, Co., Ltd.
Lever, Eric J. (Trix), Ltd.
Lissen, Ltd.
London Radio Manufacturing Co., Ltd.
M.L. Magneto Syndicate, Ltd.
Neophone Engineering Co.
Ormond Engineering Co., Ltd.
Read Radio, Ltd.
Rees-Mace Manufacturing Co., Ltd.
Whittingham, Smith & Co.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during October last amounted to £64,154, bringing up the total for the first ten months of the year to £512,922 as compared with £410,003 in the corresponding period of 1928.

Merchandise Marks Inquiries.

Among the forthcoming inquiries into applications under the Merchandise Marks Act, 1926, is one relating to motor vehicles and accessories. The latter include dynamos, starting motors, magnetic cut-outs, dashboard fittings, high-tension distributors, ignition coils, magnetos, batteries and ignition plugs.

The Timber Market.

Our Timber Trade Correspondent reports that the market for European timber lacks steadiness, imports having been very heavy over the past five or six weeks, and consequently there are large stocks on the market. Some good Russian, Swedish, and Finnish parcels are being offered and taken up by consumers at attractive rates. On the whole, consumption is satisfactory—the moot point is whether it will be maintained. The larger Russian supplies to come forward next year presage cheaper prices for building and joinery woods, and it is hoped, will stimulate consumption and encourage house-building operations. Hardwoods, excepting the American varieties, are generally steady, in demand and value, both of Empire and foreign production. The fancy woods, such as mahogany, rosewood, satinwood, and ebony are very firm in price. Teak also commands a fair return. The price outlook for next year, so far as can be observed, is cheaper building woods, and dearer (if but slightly) furniture and cabinet woods.

German Foreign Electrical Trade.

A return just issued shows that the imports of electrical machinery, cables and electrical fittings and accessories into Germany during the nine months ended September last, attained a value of £1,958,750, as compared with £1,597,300 in the corresponding period of 1928. The exports of similar material from Germany during the same period advanced from £17,980,900 to £20,766,750.

Prices of Materials.

Messrs. F. Smith & Co. and Messrs. James & Shakespeare report December 16th: No change in copper and lead prices.

Messrs. Edward Till & Co. report, December 16th: India-rubber, Para fine, 8¼d., ¼d. dec.

Messrs. James Forster & Co. state in their letter of December 14th that the lead market was again very quiet last week and transactions were mainly professional. The general position remains unchanged with supplies more than sufficient for consumption. Demand is poor and is unlikely to revive until after the turn of the year. Left to the natural law of supply and demand the price would undoubtedly stand to-day at a lower level, but, with the existing control exercised by the Producers' Association, prices may be maintained for the time being.

Lighting and Power Notes.

Arundel.—Inauguration of Supply.—The borough was recently connected to the Bognor Gas & Electricity Co.'s 11,000-V network by means of a three-mile overhead line.

Barrow-in-Furness.—Mains Extensions.—The Corporation is applying to the Unemployment Grants Committee for a grant in connection with an extension of mains to the Kirkby Quarries, estimated to cost about £4,500.

Betchworth & Brockham.—Electricity Supply Petition.—A petition is to be made by the ratepayers and housholders of the parish against the Dorking Electricity Special Order 1929, promoted by the Greater London & Counties Trust, Ltd., now awaiting confirmation by the Ministry of Transport. If the Order is confirmed the charge for electricity, it is stated, will be three times that which would be made under the national scheme of the Central Electricity Board and the London & Home Counties Joint Electricity Authority.

Brighton.—The Assisted Wiring Scheme.—As a result of a conference between representatives of the Corporation Electricity Committee and the Electrical Contractors' Association with regard to certain details in connection with the working of the assisted wiring scheme, it has been decided to pay £1 per point to any contractor who undertakes the wiring of houses which fall within the assisted wiring scheme, subject to the materials to be used being approved by the electrical engineer, or being purchased from the department as the engineer may decide in any particular case.

Loan Sanctioned.—The Committee has obtained sanction to the borrowing of £50,000 for electricity mains and services.

Burnley.—Electricity Supply Extension.—The Town Council has decided to give a supply of electricity to Cliviger at an estimated cost of £5,500.

Colchester.—Bulk Supply.—The Corporation Electricity Committee has arranged an interview with the engineer of the Frinton-on-Sea & District Electric Light & Power Co., Ltd., to discuss terms for a bulk supply by the Corporation, and is also to consider the installation of additional generating plant.

New Cables.—The borough electrical engineer submitted particulars of the lengths of cables which it will be necessary to lay in various streets in the borough within the next 12 to 18 months, the approximate total cost being £5,462. An estimate for completing the e.h.p. ring main within the borough, at a cost of £19,430, was also submitted.

Continental.—Germany.—A 440,000-kW generating station just completed at Bitterfeld, Saxony, is stated to be the largest electric power station in Europe. It will be used to supply electrical energy to the whole of middle and east Germany.—*Reuter.*

France.—The Société Union des Producteurs d'Electricité des Pyrénées Occidentales has recently secured a concession to establish a hydro-electric station to utilise the power of three falls on the River Nesta in the Upper Pyrenees.

Darlington.—Special Order.—The Corporation is to apply to the Electricity Commissioners for a Special Order authorising it to take over from the Cleveland & Durham County Electric Power Co.'s undertaking the parishes or townships of Barmpton, Great Burdon, Haughton-le-Skerne, Morton Palms, Neasham, Sadberge, and Whessoe, in the rural district of Darlington.

Dartford.—Electricity Supply Extensions.—The Urban District Council Electricity Committee recommends that work be commenced as soon as possible in carrying out a portion of the second instalment of the ring main scheme, which comprises the laying of a high-pressure cable from the sub-station in Princes Road to Temple Hill, and the construction of a sub-station in Princes Road at Temple Hill, at an estimated cost of £6,500.

Dewsbury.—Bulk Supply.—The Town Council has decided, subject to the approval of the Electricity Commissioners, to enter into an agreement with the Yorkshire Electric Power Company for the supply of electricity in bulk for distribution by the Corporation. Dewsbury's power station is scheduled to cease generation under the "grid" scheme, and the existing supply agreement with the power company is due for revision within the next few months. The station will become a transforming station, the supply being between five and six million kWh per year.

East Grinstead.—Loan.—The Urban District Council has applied for sanction to a loan of £10,000 for mains, services and meters.

Glasgow.—Mains Extensions.—The Corporation Electricity Committee recommends that distributing mains be laid at an estimated cost of £9,765.

Electricity Charges Petition.—Representatives of tenants in Glasgow Corporation houses have considered the reply of the Clyde Valley Electrical Power Co., to complaints regarding charges for electricity, and have agreed to arrange for a petition to the Government for an official inquiry into the methods of charging for electricity.

Progress During October.—Under the Glasgow Corporation Electricity Department's scheme, 848 houses were wired in October, making the total to date 17,549. Appliances let out on hire numbered 583, making the total 19,193.

Change of Frequency.—Regarding the change of frequency in the north-west district of the city, the manager of the Corporation Electricity Department has reported that a complete survey has now been made and that the approximate cost of the change-over will be £248,000, made up as follows:—Generation, £35,000; inter-connection, £5,000; distribution, £131,000; consumers, £65,000; management £12,000. The committee has approved the report as an indication of the cost of carrying out the section of the scheme referred to, and has instructed the manager to submit it to the Central Electricity Board.

Halifax.—Loan.—The Town Council is to apply for sanction to a loan of £100,000 for the extension and replacement of mains during the next three years.

Hampton.—Proposed Sale of Undertaking.—At a recent meeting of the Urban District Council a letter was received from the town clerk of Twickenham, enclosing a copy of one from the Twickenham and Teddington Electric Supply Co., Ltd., respecting the purchase of the company's undertakings at Twickenham, Teddington, and Hampton, stating that, subject to a satisfactory price being reached by agreement, the company will be prepared to sell the Hampton Wick undertaking. The communication was referred to the Council's representatives.

Cable Extensions.—The Twickenham and Teddington Electric Supply Co., Ltd., is to extend cables in Queen's Road and Burton's Road, Hampton Hill.

Hastings.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to loans of £7,000 for mains and services, and £450 for sub-station equipment.

Heywood.—Electricity Supply.—The Town Council is to open negotiations with the Bury Town Council with a view to extending the supply of electricity.

Leigh (Lancs.).—Mains Extensions.—The Town Council has received sanction to a loan of £6,929 for laying conduit lines and cables, and providing sub-station transformer equipment in the West Leigh and Pennington areas of the borough.

Lochaber.—Hydro-Electric Scheme.—According to *The Times* the Lochaber (Inverness-shire) hydro-electric scheme, started in 1925, is now reaching its final stages. A series of tests is now being made, and for this purpose water from subsidiary streams has been let into the 15-mile tunnel which has been driven through the solid rock of the Ben Nevis range. Recent tests permitted of the turbines being run light at full speed, and it is understood that the results were entirely satisfactory. The crucial test, however, cannot take place until the last rock barrier, excluding the waters of Loch Treig from the tunnel has been blasted. It is expected that this will be completed before the end of the year.

London.—Kensington.—A report of the Borough Council Works Committee states that a scheme is in course of preparation for further improvements in the street lighting, dealing first with the classified roads, next with roads not classified but traversed by buses or other considerable traffic, and then with streets in defined areas which can be dealt with completely and in sequence.

Hampstead.—At an emergency meeting of the Borough Council, held recently to consider the failure of the electricity supply three times during the last few weeks, it was decided that the Lighting Committee should be authorised to obtain expert opinion as to the causes of the breakdowns; the present administration of the lighting station, and the possibilities of obtaining additional power in the immediate future; and to advise as to the measures to be taken to secure continuity of supply in future.

Manchester.—Progress During October.—During the month of October the Corporation electricity undertaking showed an increase in connections of 2,416 kW, bringing the

total up to 398,400 kW. The number of applications received for supply including those for additional supplies, was 1,616, representing a total of 3,536 kW. The number of hired cookers connected increased by 96, bringing the total number of cookers actually connected to 5,701. Applications for the hire of cookers totalled 113. Three new sub-stations were put into commission and additional plant was installed at three existing sub-stations. The change-over from d.c. to a.c. had been completed in the cases of 8,502 consumers up to November 16th, and sanction had been given and work was in progress involving 1,214 consumers.

COOKER HIRE CHARGES.—Consequent on the earlier designs of electric cookers falling out of favour with hirers, and to prevent an accumulation of these in the stores, the Corporation Electricity Committee has reduced the charges for these older types from 7s. 6d. to 6s. per quarter.

Peterborough.—LOAN.—The Town Council has applied for sanction to a loan of £25,000 for the provision of l.p. mains, cookers, and meters.

Portsmouth.—LOANS SANCTIONED.—The Corporation Electricity Committee has received sanction to loans of £1,759 for the purchase of sites and erection of sub-stations at Lee-on-Solent, Gable Head and Stubbington, and £16,000 for electricity mains in connection with the extension to Sarisbury.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

LONDON.—*St. James' & Pall Mall Electric Light Co., Ltd.*—Power, heating and cooking: From 1d. to ¾d. per kWh. The "minimum charge" for lighting: From 10s. to 6s. per quarter for the winter quarters, and to 4s. per quarter for the summer quarters.

SEVENOAKS.—*Sevenoaks & District Electricity Co., Ltd.*—Domestic lighting: From 9d. to 8d. per kWh. Shop lighting: To 7½d. per kWh. Heating: To 1½d. per kWh.

Rotherham.—EXTENSION OF SUPPLY AREA.—Clauses are to be included in the Bill to be promoted by the Corporation in the ensuing session of Parliament, to extend the electricity supply area at Thorpe, so as to include the whole of the Thorpe Hesley and Hesley Bar.

Shropshire.—ELECTRICITY SCHEME.—The West Midland Joint Electricity Authority, whose headquarters are in Wolverhampton, has approved a £300,000 scheme for the distribution of electricity in the north-eastern section of Shropshire, which embraces 109 sq. miles and has an estimated population of 68,000. The area includes the Wellington, Newport, Oakengates and Dawley urban districts, part of the municipal borough of Wenlock, embracing Madeley, Coalbrookdale and Ironbridge, and parts of the rural districts of Wellington, Newport Shifnal and Atcham. The proposed works include 33,000-V transmission lines to connect Ironbridge, Wellington, Newport and Shifnal with double-circuit mains where required, in order to provide alternative routes as a safeguard against breakdown. The scheme is being submitted for the approval of the Electricity Commissioners, and when this is forthcoming the work will be commenced.

Torquay.—ELECTRICITY SUPPLY.—At a meeting of the Corporation Electricity Committee held recently, the town clerk reported that the Extension (No. 2) Order had now been made by the Electricity Commissioners, and the Electricity Department was instructed to make a survey of the area of supply and to submit a scheme or schemes to deal with that area as soon as possible. In regard to the Extension (No. 3) Order, the town clerk reported that the application for this Order had been lodged with the Electricity Commissioners who stated that they were prepared to consider the application of the Corporation to give supplies of electricity in bulk to the Urban Electric Supply Co., Ltd., at Dartmouth, and the Salcombe Gas & Electricity Co., Ltd., at Salcombe and Kingsbridge, but that they would defer giving approval in the latter case until the inquiry into the application for the Extension (No. 3) Order had been held.

Warrington.—LOAN.—The Town Council has applied for sanction to a loan of £1,716 for h.p. mains from Winwick to Croft, and the provision of a sub-station at Croft.

Western Australia.—YEAR'S WORKING.—The report on the working of the Government electricity undertaking (general manager, Mr. W. H. Taylor) for the twelve months ended June 30th last, records a total revenue of £278,886, as compared with £246,804 for the preceding year. The working expenditure amounted to £214,529, as against £191,443, leaving a gross profit of £64,357 (£55,361). Interest charges absorbed £56,654 and there was a net surplus of £7,703, as compared with £11,734 in 1927-28. The capital expended increased from £922,395 to £1,210,710, the principal item being £256,535 for power station extensions. The electrical energy sold increased from 60,932,360 to 68,539,228 kWh, and the maximum supply demanded from 17,300 to 20,000 kW. The average price obtained per kWh rose from 0.96d. to 0.97d. Extensions of the power station consisting of the fifth unit were completed during the year, and preparations are being made for work to commence on the sixth unit as soon as possible.

York.—SCHOOL LIGHTING.—At a recent meeting of the Corporation Education Committee it was reported that of the 18 non-provided schools in the city, electric lighting had been installed in 13, and it was decided to urge the managers of the five remaining schools to change over from gas to electricity as soon as possible.

Tramway and Railway Notes.

Australia.—NEW SOUTH WALES.—The report of the New South Wales Railway Commissioners for the year ended June 30th last, states that the total revenue obtained from the electric trams in the Sydney metropolitan area amounted to £4,061,459, as against £4,135,337 in the previous year. The working expenditure was £3,471,394, as compared with £3,465,920, leaving a gross profit of £590,065 (£669,417). From this had to be paid £514,478, interest on loans, and £27,086, contribution to sinking fund, leaving a net surplus of £48,501, as compared with £163,394 in the preceding year. The number of passengers carried decreased from 322,025,235 to 312,032,469, and the car mileage from 31,511,169 to 31,258,936.

The gross revenue from the Newcastle tramways was £351,363, as compared with £374,420 in 1927-28. Working expenses were £301,577, as against £307,637, while the gross profit decreased from £66,783 to £49,786. Interest on loans absorbed £80,254 and sinking fund a further £4,225, leaving a net deficiency of the year of £34,693, as compared with £11,192 in the previous year. The number of passengers carried decreased from 20,180,992 to 17,807,702, and the car miles run from 2,645,486 to 2,505,805. Most of the tramcars are now operated by electricity and the few steam vehicles which remain are to be replaced by electric cars.

Details are also given in the report of the steam power stations which generate the power required for the railways and tramways of Sydney and Newcastle. The total energy generated during the year by the Ultimo and White Bay stations at Sydney, was 420,708,460 kWh, as against 393,128,095 kWh in the preceding year. Of this 115,658,827 kWh was utilised for the electric railway system, and 116,011,600 kWh was taken in bulk by the Sydney Municipal Council. There was an increase from 51,052,260 to 55,976,614 kWh in the electrical energy generated at the Zarra Street station at Newcastle, and of this 40,403,882 kWh was sold in bulk.

Bradford.—RAILLESS-CAR EXTENSIONS.—The Corporation Tramways Committee recommends the extension of the railless-car service from Five Lanes End, through Idle to the Albion Mills at Greengates, as it is reported that the tramway track to Idle is worn out. A railless-car service will shortly come into operation on the Thackley route.

Colchester.—TRAMWAY ABANDONMENT.—The Corporation tramway service has now been completely replaced by motor-'buses.

Rotherham.—RAILLESS CARS.—The Corporation Transport Committee has appointed a sub-committee to decide upon the type and to accept a tender for the supply of twenty railless cars for operation on the Dalton and Kimberworth routes.

Western Australia.—YEAR'S WORKING.—We have received from Mr. W. H. Taylor, general manager of the Government tramway undertaking, a copy of his report for the year ended June 30th last. The total revenue amounted to £342,788, as compared with £318,957 in the preceding year. Working expenses, including £21,000 for relaying of track, totalled £281,257, as against £259,677, leaving a gross profit of £61,531 (£59,280). After providing for capital and other charges there was a net surplus of £11,376, as compared with £10,481 in 1927-28. The capital expenditure during the year amounted to £19,105, bringing the total now spent on the undertaking to £1,069,352. The number of passengers carried increased from 32,657,626 to 35,031,734, the car mileage from 3,188,087 to 3,345,929, and the revenue per car mile from 24.01d. to 24.59d.

Telegraph and Telephone Notes.

Australia.—AUTOMATIC TELEPHONY.—The Central and Paddington automatic telephone exchanges have just been successfully opened for public service at Brisbane. The event is notable because the transfer of the two exchanges, totalling nearly 10,000 lines, is the largest so far undertaken in Australia. Conversion to the automatic system was commenced in 1925, when the South exchange, with nearly 4,000 lines, was opened. Since then the system has steadily grown until it now comprises three main automatic exchanges and seven satellite exchanges equipped for a total of over 20,000 lines. All the automatic exchanges in the Brisbane area have been manufactured and installed by Messrs. Siemens Brothers & Co., Ltd., Woolwich.

Channel Islands.—TELEPHONE CABLE.—A scheme to use a secret submarine cable, which was laid across the English Channel during the 1914-18 war, to provide a telephone service between the Channel Islands and the mainland has been placed before the British authorities by the Telephone Council of Guernsey. The cable, said Deputy Charles Kitts, addressing the Guernsey Chamber of Commerce, was laid between Dartmouth and France, and passed close to the western coast of Guernsey. By tapping it at the nearest point, it should be possible to establish direct telephone communication between

England and the Channel Islands at a reasonable cost. He added that, as a member of the Telephone Council, he had seen responsible people in London with regard to the project, and they were impressed with the advantage of a cheap telephone service for British buyers of the fruit, vegetables, and flowers exported in such large quantities from the islands. The line tapping the cable would come ashore probably at Saints Bay, and Guernsey would be the central exchange for the islands. The telephone authorities in London confirm the statement that negotiations are in progress with the island authorities.

France.—RURAL TELEPHONY.—In the National Development Bill just submitted to the French Parliament, a sum of £1,700,000 is provided for the development of automatic telephone systems in rural districts, the expenditure to be spread over a period of five years.

Radio-telephony.—POLICE SERVICE.—If Parliament gives its sanction, France will shortly have a wireless police service. Besides permitting rapid communication between Paris and the provinces, it will be at the disposal of the international police organisation (see ELEC. REV., December 13th, 1929, p. 1052). By direct wire to the Eiffel Tower, the French Sûreté will be able to transmit descriptions and also photographs and finger prints. Fifty-one provincial receiving stations will be established.

Russia.—TELEPHONE RESEARCH.—A large new central laboratory for research work in long-distance telephony and telegraphy has lately been completed in Moscow.

The Telephone Service.—STEADY INCREASE.—The total number of telephone stations in the British Post Office system on September 30th, 1929, was 1,814,263, a net increase for the month of 10,336, of which total 161,623 were in Scotland and 22,448 in Northern Ireland. London's share was 647,967, an increase of 3,527 for the month, of which 157,083 were residence-rate subscribers (month's increase 1,361) and 5,717 were call-office stations, including 1,479 kiosks. The provinces claimed 1,166,296, the increase for the month being 6,809, of which 247,645 were residence-rate subscribers (month's increase 2,067) and 22,952 were call-office stations, including 5,662 kiosks.

TRUNK CALLS.—The total number of inland trunk calls dealt with in July, 1929, was 10,653,433, representing an increase of 1,150,626, or 12 per cent., over the total for the corresponding month last year.

INTERNATIONAL TRAFFIC.—Out-going international calls in July, 1929, numbered 46,774 and incoming international calls 49,742, representing increases of 11,031 (30.9 per cent.) and 11,236 (29.2 per cent.) respectively, over July, 1928.

U.S.A.—CABLE AND WIRELESS UNIFICATION.—The unification of the American wireless and cable telegraph communication systems to meet foreign competition was advocated before the Senate Inter-State Commerce Committee on December 9th by Mr. Owen D. Young, chairman of the Radio Corporation of America. He said that Great Britain and France had already introduced unification, and Germany was doing so; in Italy and Japan the services were unified under Government control. He declared that it was impossible for competitive companies in America "to meet these consolidated units in other countries from the standpoint of national interest."—*Reuter's* (Washington).

Radio Notes.

A Wireless Anniversary.—TRANSATLANTIC RECEPTION.—Thursday, December 12th, was the 28th anniversary of the Marchese Marconi's historic reception at St. Johns, Newfoundland, of the first wireless signal to be received across the Atlantic Ocean. The first British patent for wireless telegraphy taken out by the Marchese Marconi was dated June, 1896, four months after he came to this country from Italy. At the request of the National Broadcasting Company of America and by the co-operation of the British Broadcasting Corporation and the British Post Office, the Marchese Marconi broadcast from England for retransmission through the American stations a description of his experience at St. Johns, Newfoundland, when receiving the famous "S" signal from Poldhu, Cornwall, on December 12th, 1901. The broadcast was transmitted to the United States through 5SW, the short-wave experimental station at the Marconi works, Chelmsford. The Marchese Marconi spoke from the Savoy Hill studios, and had with him Mr. G. S. Kemp and Mr. P. W. Paget, two of his earliest assistants who were with him at St. Johns in 1901, and who are still working in association with him.

Modulation.—U.I.R. RECOMMENDATION.—In the course of its meetings, held recently at Barcelona, the Council of the Union Internationale de Radiodiffusion adopted the report of its Technical Committee on the results of the Prague plan of wavelength allocation. The Council agreed to the steps recommended by the Technical Committee towards the more rigorous enforcement of measures to restrict broadcasting stations to the wavelengths accorded to them, and to reduce the grave interference occasioned by over-modulation practised by some Continental stations, producing harmonics of the modulating low frequency.

The B.B. Co.—WOUND UP.—The British Broadcasting Company formally ceased to exist on December 12th, 1929. Its last statutory meeting, which was private, was held in London to receive from Sir John Reith, the liquidator, an account of how its property had been disposed of. The first B.B. Co. programme was transmitted from the London (2LO) station on November 14th, 1922. The Corporation, which succeeded the Company, was instituted by Royal Charter on January 1st, 1927.

Wireless in Schools.—BATTERY ELIMINATORS.—The L.C.C. Education Committee, reporting upon the use of wireless apparatus in elementary schools, says that it has been the general practice to decline applications for the fixing of wireless apparatus to electric light installations, but in view of the general tendency of manufacturers to contruct sets which require no batteries, the committee considers it desirable that such facilities should be provided for the use of the most modern apparatus in the Council's schools, provided that its chief engineer is satisfied about the suitability and safety of the apparatus. The cost of the electricity used by wireless apparatus is practically negligible, but the committee does not undertake to defray the cost of the apparatus.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraph Department. January 7th. Telephone hand sets. (B.X. 5823.)* Contact pressure testers. (B.X. 5821.)* Telephone cable and terminal boxes. (B.X. 5938.)

January 14th. Ringing motor-generator sets for automatic telephone exchanges. (B.X. 5839.)* Telephone indicators. (B.X. 5822.)*

January 28th. Induction coils and register plates. (B.X. 5899.)*

February 25th. Jumper rings and terminal strips. (B.X. 5941.)*

February 18th. Jacks and number plates. (B.X. 5940.)*

January 13th. State Electricity Commission of Victoria. 2,200-V switchgear and accessories. (B.X. 5827.)*

Belgium.—January 8th. Belgian Post and Telegraph. Salle Madeleine, Brussels. 250 tons of bronze wire, in five lots, and five tons of annealed soft copper wire. Particulars (Cahier des Charges Special No. 3455) for 2½ francs.

Bradford.—December 31st. Corporation electric passenger- and goods lifts at block of shop and office premises, Leeds Road, Bradford Street, and Hall Buildings. Form of tender from city architect, Town Hall.

Dumbartonshire.—The Education Authority is inviting tenders for the installation of electric light in Cardross Public School.

Dundee.—January 15th. Electricity Department. Supply of two 300-kVA outdoor-type transformers and one 200-kVA outdoor-type transformer. (See this issue.)

Edinburgh.—December 23rd. Education Authority. Electric installation at Nursery School, Tollcross. Schedules from Authority offices, Castle Terrace.

Egypt.—CAIRO.—December 28th. Ministry of Public Works. Electric generating and pumping sets for Mankabad Barracks. (B.X. 5842.)*

February 1st. Ministry of the Interior. Centrifugal well pump and direct coupled electric motor with piping and accessories. (A.X. 8811.)*

Leeds.—December 27th. Board of Guardians. Electric lamps for the period ending March 31st, 1930. J. H. Ford, Clerk to the Guardians, Poor Law Offices, 11, South Parade, Leeds.

Liverpool.—December 23rd. Electricity Supply Department. Supply of twelve 750-kVA transformers. (December 13th.)

London.—CENTRAL ELECTRICITY BOARD.—December 21st. Supply, delivery and erection of 132,000-V transformers for the Mid-East England Electricity Scheme, 1929. (November 22nd.)

January 6th. Supply, delivery, and erection of 132-kV overhead transmission lines (special crossings and high spans), for the North-West England and North Wales Electricity Scheme, 1928. (November 29th.)

January 20th. Supply, delivery and erection of 3,300-V, 6,600-V and 11,000-V switchgear for connecting the Board's supply to undertakers' busbars, North-West England and North Wales Scheme. (December 13th.)

ISLINGTON.—January 9th. St. Mary Parish Guardians. Supply and erection of five automatic electric lifts at the Infirmary, Highgate Hill, N. (December 6th.)

January 17th. Electrical and engineers' stores for one year commencing April 1st next. (December 13th.)

METROPOLITAN ASYLUMS BOARD.—January 2nd. Alterations to electric lighting installation at the South-Western Fever Hospital, London Road, Stockwell, and installation of car-washing and disinfecting apparatus at Brook, North-Western, South-Eastern and South-Western ambulance stations. (December 6th.)

January 2nd. Replating a 500-ampere-hour electrical storage battery at St. Luke's Hospital, Lowestoft. (December 13th.)

Lourenço Marques.—January 3rd. Tender Department of the Treasury. One oil-engine-driven d.c. generator and battery. (B.X. 5961.)*

Maidstone.—January 16th. Committee of Visitors. Electrical installation for lighting, heating, &c., at the Mental Hospital, Barming Heath. (See this issue.)

New Zealand.—WELLINGTON.—Post and Telegraph Department. January 13th. Four point jacks. (B.X. 5840.)*

January 16th. Telephone switchboard plug covers. (B.X. 5879.)*

January 21st. Spare parts for automatic telephones. (B.X. 5917.)* Reed-type tension gauges. (B.X. 5918.)*

January 27th. Breastplate transmitters. (B.X. 5956.)*

February 3rd. Protector blocks made of carbon and porcelain. (B.X. 5948).*

February 13th. Opal lamp caps. (B.X. 5955.)*

Public Works Department. January 14th. Two air compressors and two electric motors. (A.X. 8784.)*

January 28th. Three 50-kW oil-immersed circuit breakers for Arapuni. (B.X. 5878.)*

January 21st. Four electric motor-driven ventilating fans. (A.X. 8857.)*

South Africa.—BLOEMFONTEIN.—January 10th. Electricity Supply Department. Automatic electric traffic signals. (B.X. 5887.)*

JOHANNESBURG.—January 4th. Stores Department. Automatic traffic signals. (B.X. 5924.)*

CAPE TOWN.—January 7th. Electricity Department. Supply of 3-core 11,000-V cable. (B.X.5925.)*

Stoke-on-Trent.—December 31st. North-West Midlands Joint Electricity Authority. Supply and erection of e.h.p. and l.p. overhead transmission lines. (December 13th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Barnsley.—Borough Education Committee. Accepted:—
Electrical equipment of the grammar school laboratories (£240).—Corporation Electricity Department.

Carlisle.—Town Council. Accepted:—
Wiring 250 houses for electric light.—R. M. Hill & Sons.

Croydon.—Tramways Committee. Recommended:—
Spare motor for London service cars (£203).—General Electric Co., Ltd.
Electricity Committee. Recommended:—
Two 1,000-kVA transformers (£924).—British Electric Transformer Co., Ltd.
Sewage Committee. Recommended:—
Electric wiring at sewage works (£385).—J. & T. Robinson.

Dewsbury.—Town Council. Accepted:—
Cable (£2,035).—Power & Lighting Cables, Ltd.
It was stated that the difference in price between the British and German tenders was 12 per cent.

Glasgow.—Electricity Committee. Recommended:—
Two frequency changers (£572).—Macfarlane Engineering Co., Ltd.
Two reconstructed rotary convertors (£246) and nine motors (£1,062).—Metropolitan-Vickers Electrical Co., Ltd.
29 motors (£516).—Crompton Parkinson, Ltd.
24 motors (£269).—English Electric Co., Ltd.
Municipal Transport Committee. Recommended:—
Copper trolley wire (£1,204).—Felten & Guilleaume, per W. F. Dennis & Co.
Forged m.s. cable rings for subway.—Fullerton, Hodgart and Barclay.
Fishplates for subway rails.—Bolckow, Vaughan & Co., Ltd.
D.c.c. wire.—R. Johnson, Clapham & Morris, Ltd.
Conveyor plant parts for Pinkston.—North British Steel Foundry Co., Ltd.; Miller & Co., Ltd.; Lanarkshire Bolt Rivet Co., Ltd.; P. & W. MacLellan, Ltd.

Hastings.—Electricity Committee. Recommended:—
Overhead and underground cables to Battle. Schedule rates (total cost estimated at £7,435).—W. T. Glover and Co., Ltd. 5,000-kVA transformer (£1,495).—Ferranti, Ltd.

London.—CITY CORPORATION.—Health Committee.
Provision of electric lighting at crematorium buildings:—

W. J. FURZE & Co., LTD., (Recommended)	£563 0 0
Pinchin & Walton, Ltd.	588 10 0
Electrical Installations, Ltd.	596 14 2

EAST HAM.—Electricity Committee. Recommended:—
Control battery and switchboard (£265).—Hart Accumulator Co., Ltd.

Rotherham.—Electricity Committee. Recommended:—
2,600 yd. of 0.1 in. three-core e.h.p. cable (£1,352) and 1,200 yd. ditto (£620).—Callender's Cable and Construction Co., Ltd.
Two pairs 10,000-kVA, 6,600 V-type switches, £256 per pair plus £9 11s. 3d. per switch for automatic control; one 3,300-V switch equipment (£303) and one l.p. switch equipment (£228).—A. Reyrolle & Co., Ltd.
Two oil switches and meter panel (£249) and one 450-h.p. and one 110-h.p. a.c. motors (£630).—British Thomson-Houston Co., Ltd.

Sowerby Bridge.—Urban Council. Accepted:—
Electrical work at houses at Beechwood.—J. Harrison and Co. (Halifax).

Stoke-on-Trent.—Education Committee. Accepted:—
Electric kiln at the Burslem School of Art (£110).—R. M. Catterson-Smith.

Forthcoming Events.

British Electrical Development Association.—Friday, December 20th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. Display of propaganda kinematograph films.

Birmingham Electric Club.—Friday, December 20th. Grand Hotel, Birmnigham. 7 p.m. Annual meeting.

Salford Technical and Engineering Association.—Thursday, December 26th. Royal Technical College, Salford. Annual social.

Institution of Electrical Engineers (Meter and Instrument Section).—Friday, January 3rd. Savoy Place, Victoria Embankment, W.C., 7 p.m. "Instrument Transformers." Mr. J. G. Wellings and Mr. C. G. Mayo.

Institution of Mechanical Engineers.—Friday, January 3rd. Institution, Storey's Gate, S.W., 6 p.m. Thomas Lowe Gray Lecture: "Progress in Marine Engineering." Eng.-Vice-Admiral R. W. Skelton.

Junior Institution of Engineers.—Friday, January 3rd. 39, Victoria Street, S.W., 7.30 p.m. "Speedy Draughtmanship." Mr. F. T. Woods.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

DONOVAC vacuum cleaners.
VIVOS vacuum cleaners.
GRAYBAR stimulators (agents for).

Notes.

Manchester Electrical Engineers' Dance.

This very popular annual gathering took place at the Midland Hotel, Manchester, on Friday last, some 230 guests being present. In accordance with the Manchester tradition, a cabaret show added to the enjoyment of the evening, the acrobatic dancers and roller skate exponents being so skilful as to challenge to the utmost the feats of the ordinary dancers. Among those present, and full of activity, were Col. Cortez-Leigh, Messrs. S. E. Fedden, H. C. Lamb, L. Romero, A. McKinstry, P. N. Rand, and R. S. Pilcher.

An excellent band (the Midland Hotel orchestra) and the distribution of balloons and favours all helped to provide the usual delightful entertainment, on which Mr. C. D. Taite, Mr. Harcourt Williams, and the executive committee may once again be most heartily congratulated.

Protection Against Lightning.

The United States Bureau of Standards has issued a report (Miscellaneous Publication No. 95) dealing with the application of lightning arrestors to electrical lines and equipment. The report has been drawn up by a committee representing the various technical societies and others concerned with the subject. The protection of power, railway, signalling, and communication circuits and apparatus is described; the bulk of the report deals with the application of lightning arrestors to power and railway circuits, but other methods of protection, such as the use of overhead ground wires, are also discussed, and the report points out how a proper selection and application of arrestors will greatly reduce trouble and avoid frequent interruptions of service. The Bureau emphasises the fact that it is only a preliminary report, and comments and suggestions from those interested will be welcomed. The investigation of the properties of lightning is now being carried out more intensively than ever before, and it is expected that within a short time our knowledge of lighting and of the methods of combating its effects will be greatly increased.

An Improved Petrol-electric Vehicle.

The TS17A-type petrol-electric chassis, suitable for double-deck 'bus bodywork of about 52 passenger-seating capacity, exhibited by Messrs. Tilling-Stevens Motors, Ltd., at the recent Commercial Motor Show at Olympia, was of an improved type. Fitted with a 4-cylinder 36/95-h.p. engine, the first of these vehicles is at present in regular London service, and the newcomer marks a considerable advance, as compared with its predecessors. The main problem has been to produce a machine of the capacity stated that would come within the maximum laden weight of 9 tons specified by Ministry of Transport Regulations for four-wheel passenger vehicles. When the considerably heavier weight of the electrical units, as compared with the ordinary clutch and gear box, is taken into account, it will be realised that to have done so is a remarkable achievement. It has been accomplished mainly by constructing many parts of "Elektron," aluminium, and duralumin in place of heavier metals formerly used. "Elektron" has a tensile strength equal to that of aluminium, though it is 40 per cent. lighter, and it needs special caution in machining operations as, owing to its magnesium content, the turnings are liable to become incandescent unless quenched with lubricant.

During a series of tests carried out by the makers, the new machine, with a gross laden weight of 9 tons, could be moved on the level with the engine turning at 380 r.p.m., and for a quick start it does not rise above 1,500 r.p.m. The acceleration figures obtained were:—

Seconds.	m.p.h.	Seconds.	m.p.h.
5 ...	... 13.75	30 ...	... 29.75
10 ...	... 18.5	35 ...	... 30.87
20 ...	... 24.25	40 ...	... 31.75
25 ...	... 27.25		

The rates of acceleration at the lower speeds are exceptionally creditable, and would be very difficult to equal with a gear-driven vehicle, particularly in view of the time ordinarily occupied in changing gear. The value of such an accomplishment under 'bus service conditions need not be emphasised.

Electric Shock Fatalities in Australia.

In connection with the revision of the Electric Wiring Regulations in which the Standards Association of Australia is engaged, information was sought concerning the number and causes of electrical fatalities in each State of the Commonwealth. According to the *Industrial Australian and Mining Standard* the inquiry elicited the fact that the number of deaths in Australia due to this cause is approaching 50 per annum, the total in 1927 having been 46. Most of the accidents resulted from unearthed conduit and defective flexibles, and sometimes badly wired lamp sockets; these defects are due sometimes to faulty workmanship, but more often to the ignorance or carelessness of the persons handling the apparatus. It is stated on reliable authority that the number of deaths from electric shock in the U.S.A. does not exceed one per million of the population per annum, against seven to eight per million in Australia.

Railway Electrification.

The Committee on Electrification of Steam Railroads of the National Electric Light Association (U.S.A.) has recently issued its annual report. ($1.15.)

This report is of more than usual interest in that it summarises the leading particulars of electrified railways throughout the world, giving information as to mileage, systems, and reasons for and results of the change over. Appendices include a comprehensive study of railway electrification in Europe (containing a large number of good illustrations), recommendations in regard to the features which should be inserted in railway power contracts, and statements by railway presidents as to the present trends in practice.

Thawing Water Pipes by Electricity.

For more than twenty-five years the thawing of pipes by electricity has been known in Switzerland, but it was only during the intense cold of the first three months of 1929 that a truly practical method of coping with such conditions was evolved. The Entreprises Electriques Fribourgeoises have installed an electric thawing installation in dozens of private water-supplies in Fribourg, Moudon, Payerne, Schwarzenbourg, &c., much to the advantage of householders. The installation consists of a transformer which reduces the voltage of the house supply to that requisite. The two terminals are connected to the two ends of the section that is in need of thawing, whether it be in the house itself or between two houses. The current is then switched on, and very shortly the water is thawed, and all danger of a burst pipe eliminated, as well as the unwelcome visit of a plumber.

Lifeboat Wireless-Telephony.

Reproduced herewith is a photograph of the wireless outfit of the new Dover lifeboat which, with its two 375-h.p. engines, is the fastest lifeboat in the world, and has been specially designed for the rescue of people from aeroplanes which may fall into the sea. Included in its equipment is a special type

of Marconi wireless telephone set for communicating with aircraft, aerodrome, ships, and coastal wireless stations. It is a totally-enclosed installation, known as the type XMB.1, designed for use under the roughest conditions, and normally will work with a transmitting power of 100 watts on a wavelength of 900 metres.

B.S.S. for Bare Annealed Copper Wire.

A revision of British Standard Specification No. 128 has just been issued, and it is intended to meet the needs of users of bare annealed high-conductivity copper wire for winding electrical machinery and apparatus. One of the principal differences between the new and the 1922 editions is that the tolerances permitted on the resistivity of the copper and on the diameter of the wire are smaller in the new edition. A further difference between the new and the old editions is that in the latter specification the tables showed the standard resistance corresponding to the standard maximum and minimum permissible diameters of the wires, whereas the tables in the new specification give the standard resistances of a wire of standard diameter and show the *actual* maximum and minimum permissible resistances of all wires, irrespective of the variation in diameter from the standard diameter within the tolerance provided. In other words, the maximum and minimum resistances take account of both the tolerance on specific resistance of copper and the tolerance on standard diameter of wire, no further tolerance therefore being allowed on the values given in the tables of the specification.

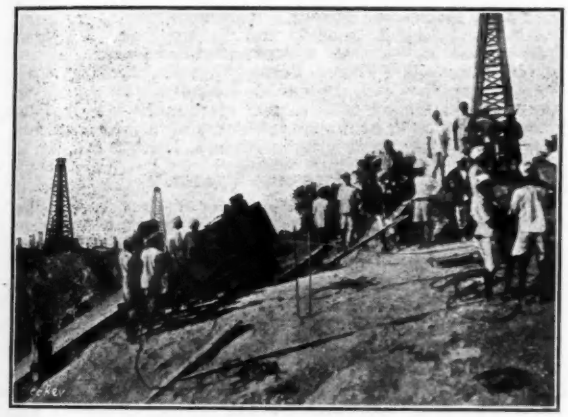
Copies of the new specification, No. 128, 1929, may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d., post free.

Electric Vehicles in France.

Coincident with the development of motor vehicles equipped with generators for the production of producer gas as a substitute for petrol for the engines, considerable progress is being made in France in the use of electric vehicles. In Paris the Société des Vehicules Electriques Industriels Sovel has recently taken a financial interest in the Compagnie des Camions Electriques, which has opened a large garage and service station near the Nord and Est railway goods yard, where not only can electric vans and lorries be garaged, but batteries charged also, and all necessary repairs undertaken. A vehicle maintenance system is also in operation, while a fleet of vehicles is kept for hiring purposes. Similar work is being done in Lyons by the Société Lyonnaise pour l'Exploitation de Vehicules Electriques, where such progress has been made that the first garage for forty vehicles is now so fully occupied that a second establishment for 100 vehicles is about to be opened. At Strasburg, too, there has lately been formed the title La Société Alsacienne de Vehicules Electriques, the purpose of which is to establish similar enterprises in Strasburg and Mulhouse.

Electrical Equipment for Oilfields.

Not only is oil-well pumping equipment subject to onerous conditions of service, but the location of the oil-fields themselves is often also such that the transport of machinery to the site is particularly arduous, as may be noted from the accompanying illustration, which shows a stage in the transport of a



B.T.-H. motor-control unit to a large oil-field in Burmah. It is interesting to mention that, in addition to many electric motors and control equipments for duty in oil-fields, the British Thomson-Houston Co., Ltd., has manufactured steam-turbine plant, switchgear, &c., of special design to meet the prevailing conditions.

A Large Welded Condenser.

What is said to be the first large all-welded surface condenser for a stationary power plant is now in operation in the Parr Shoals station of the Broad River Power Company at Parr, S.C. This condenser, having 27,000 sq. ft. of condensing surface and serving a 30,000-kW turbine, went into regular operation on September 10th, and has since been giving entire satisfaction.

A study of European condenser design and of marine practice over the past twenty years reinforced preliminary impressions that by substituting welded construction for cast-iron, some saving would be made in first cost, and that a substantial reduction in air leakage would be effected.

The question of weight influenced the decision for a welded condenser in two ways: first, by cutting down the initial cost, and, secondly, by making more feasible a special suspended construction to keep clear the floor space beneath the condenser. The steel used for the shell of the condenser is 7/16 in. thick, whereas the corresponding cast-iron thickness would have been of the order of 1¼ or 1½ in. To guard against corrosion it was decided to build the condenser of copper-bearing steel. All joints in the sheet itself are double V-butt welds. All welds were made by the stable-arc process.

Copper-bearing iron was used for the tube plates. The tube plates are 1¼ in. thick, the tubes having an outside diameter of ¾ in (17 gauge). The tubes, of Admiralty metal, were ordered with the inlet ends rounded to approximately ¾ in. radius, the inlet tube plate being machined at the tube holes to fit this curvature. After the tubes were in place they were rolled inside their cylindrical contacts.

The construction of the shell is similar to that employed in shipbuilding. Butt joints are reinforced with T-bars (5×5 in.) both inside and out. The inside bars, as may be seen from the drawing, run up and down, while those outside run longitudinally.

The vacuum obtained ranges from 28.4 in. to 28.05 in. for water inlet temperatures of 85 deg. Temperatures obtained at the turbine exhaust and in the condensate, differ by amounts varying from zero to 2.4 deg. F. It is believed that the rolling of the tubes in the tube plates, together with the use of welded construction, are largely responsible for the low air leakage indicated.

Electricity on Board Ship.

In his presidential address to the Institute of Marine Engineers, Engineer Vice-Admiral Sir Robert B. Dixon, K.C.B., D.Eng. (retired: Engineer-in-Chief of the Fleet from 1922 to 1928) dealt generally with the development and trend of marine engineering during the last few years, which, until fairly recently, was generally very conservative. Although the Navy was probably the first user (*viz.*, in submarines) the mercantile marine was the first to adopt the heavy-oil engine for surface ship propulsion, and the rapid rate of development of the turbine for marine use was facilitated by the design policy of the British Admiralty. Since the war the oil engine had challenged the supremacy of the steam engine with no uncertain voice, and severe competition had stimulated the development of the steam engine in several directions. It appeared that there was no possibility of any striking improvement in the efficiency of the Diesel-engine cycle, and economies which might be effected must be obtained outside the engine cycle proper; for example, by the utilisation of waste heat, so that sufficient steam could be generated to drive some of the auxiliary engines direct, or to drive turbo-generators which generated electricity for motor-driven auxiliary machinery, or to distil fresh water. The utilisation of the exhaust gases in a waste-heat boiler in that manner probably increased the overall efficiency of the machinery installation by four to five per cent. The cost of driving auxiliary machinery might become considerable, and there were as many alternatives as of designs of main engines, so that it was difficult to point to any particular method as offering an outstanding overall advantage. One noticeable development, however, was the wider use of electrically-driven auxiliaries, and, taking everything into account, he was of the opinion that the advantages of that system were such that in mercantile marine machinery in the future the use of electrical appliances would be considerably extended.

For providing power for liners, steam machinery was far ahead of the oil engine as regarded reliability and efficiency; the full possibilities of the steam cycle had yet to be realised, and he was inclined to think that the steam cycle would hold its own for most ships operating under conditions other than those specially favourable to the oil engine, particularly for passenger liners.

One of the desirable virtues in propelling machinery was flexibility; he believed it was that consideration which had led to the extended use of the electric drive, both for turbine and Diesel machinery. The electric drive was more suitable for turbine than Diesel machinery, because the rotating masses of high-speed turbines and generators presented no serious balancing problems such as must be faced with high-speed reciprocating masses involved by Diesel machinery in large ships, and the comparative freedom from vibration with the turbine type of machinery was a very big asset.

The chief advantage claimed for electric propulsion was that the power-generating machinery was separated mechanically from the propelling machinery, so that one or more generating units could be used to generate power for the whole of the propelling machinery. By that means the ship, when service conditions rendered it possible to close down a section of the generating plant, could be operated more economically at low powers than with the direct drive, and reserve power could be provided to operate at an economical rate. The system permitted the turbines being run at the highest possible speeds consistent with the output for which they were designed, and a high steam efficiency was thereby obtained, but against high-efficiency must be off-set the relatively lower efficiency of the transmission. In his opinion that method of transmitting the propelling power was more costly and less efficient than transmitting it through well designed gearing.

"Talkie" Film Apparatus.

The British Thomson-Houston Co., Ltd., is reported to be undertaking the production of "talkie" apparatus, one of the first of which is to be installed at the Globe Picture Theatre, Coventry. The equipment caters for both film and disk record reproduction, and is designed for operation from the mains by means of a directly-coupled motor-generator having three separate generators. For sound-on-film reproduction an improvement is claimed in the use of a new element for the photo-electric cell, and one valve only is used in the first amplifier mounted on the projector. A feature is the provision of spare lamps mounted so that they can be instantly replaced. A special form of contant-speed motor has been evolved which ensures maintaining correct musical pitch; it drives directly the turn-table, and, through a gearbox and silent chain, the projector. The speakers used are of the electro-dynamic type, the fields being excited off the motor generator. The frequency curve of the amplifier and speakers is stated to be exceptionally good.

Television.

Dr. Vladimir Zworykin, research engineer of the Westinghouse Electric & Manufacturing Co., has made a device which receives moving pictures transmitted by wireless, and reveals them upon a cathode-ray tube which takes the place of the existing glow valve, scanning disk, and motor, and is said to be easily attached to any receiving set. It is a cone-shaped tube with a flat end, upon which the transmitted moving picture appears. Dr. Zworykin admits that his device lacks perfection, but he declared that visual broadcasts synchronised with sound would become commonplace.

The Drumm Battery.

Considerable interest continues to be shown in the secondary battery invented by Mr James Drumm, of Dublin, which is being financially backed by the Irish Free State Government. No particulars of the new battery are available, for, although a search at the British patent office shows that so far this year no fewer than seven applications in respect of storage batteries have been filed by Mr. Drumm, none has so far reached the stage of the issue of either a provisional, or complete, specification.

A Large Hydro-Electric Development.

On October 12th last work was commenced at Beauharnois, Quebec, on the construction of one of the world's largest engineering projects, including the erection of a hydro-electric generating station. The Beauharnois Power Corporation has secured authority from the Provincial Government of Quebec and from the Dominion Government for the construction of a power and navigation canal taking water from the River St. Lawrence at a point close to Valleyfield, on Lake St. Francis, and débouching into Lake St. Louis lower down the river, about 18 miles away. The length of the canal itself will be about 15½ miles. The power house, which will be erected on the banks of Lake St. Louis, will be half a mile long and 95 ft. in height, with accommodation for 50,000-h.p. generators spaced at about 68 ft. apart. The plant will utilise a drop in water level of 83 ft., and in the four rapids intervening between the two lakes there is a total flow of about 200,000 cu. ft. per sec. The company has drawn up plans for an initial installation of 500,000 h.p., having been permitted to withdraw up to 40,000 cu. ft. per sec. at the outset of its operations. The first step in the construction will be provision for the generation of 200,000 h.p. to be marketed by October, 1932. The company is of opinion, however, that there would be no difficulty in producing up to 350,000 by that date if it were found necessary to to do so, and it is reported that negotiations are proceeding between the promoters and the Hydro-Electric Power Commission of Ontario for the conclusion of a contract for the supply in Ontario of 250,000 h.p. to meet the industrial development of the eastern districts of that province. After the provision of the first installation of 500,000 h.p., the expansion of the plant to its designed capacity of 2,000,000 h.p. will await the demands of industry in the vicinity. The cost of the navigation canal itself will be $15,000,000, with annual charges of about $1,000,000. The cost of the initial installation of 500,000 h.p., including the canal, power house, control works, generators, and complete electrical installation is estimated at $65,000,000, or $130 per h.p. A further development to 700,000 h.p. is placed at $106 per h.p. and an ultimate development of 2,000,000 h.p. as low as $50 per h.p.

Women and Electrical Engineering.

The head of the year in the Electrical Engineering Department of the Birmingham University was a girl, said Prof. W. Cramp, speaking at the recent annual dinner at Birmingham of the Midland Branch of the Junior Institution of Engineers. Not only so, the *Birmingham Post* reports him as adding, but she was also a head and shoulders above any of the men in originality, persistence, and patience, which showed that the thin edge of the wedge was being driven home with force. Women had a rôle to fill, especially in electrical engineering, which could not be adequately filled by men. He hoped to see more of them entering the profession.

Racecourse Totalisators.

The statement which Lord Hamilton of Dalzell (a representative of the Jockey Club on Racecourse Betting Control Board and chairman of the committee appointed to pilot through Parliament the Bill that was to legalise pool-betting on British horse-race courses) recently made to his fellow-members of the Club was explanatory of the Board's policy relative to its use of automatic electro-mechanical totalisators, but it did not indicate why several installations that were planned to be ready for this autumn's meetings will not be in use this year. His remarks about the "degree of portability necessary for the equipping of a large number of racecourses" are of interest, since electrical operation is essential, hand operation being too slow for the volume of business to be done. However, most English race courses are somewhat remotely situated from sources of electricity supply; moreover, the laying of cables or the installation of local generating plant, would be uneconomical, as the totalisators function for only a few days each season. The use of batteries of accumulators has accordingly been resorted to. Three separate 2-volt cells are assembled in a crate, 18 sets of such crates comprising a "tote" battery of 54 cells in all, the whole being of very robust construction. They are mounted on specially adapted motor lorries, together with a swichboard and other necessary auxiliary apparatus, and thus transported from place to place and stationed at the rear of the machine, where they do their work silently and efficiently. Batteries are allocated to different districts, and are moved from one racecourse to another as required. The first six batteries supplied by the D.P. Battery Co., Ltd., have each an output of 500 ampere-hours at 100 volts, and are of the "Kathanode" type. The systems employed differ slightly in detail, but with the full automatic equipment the pressure of a key on one of the numerous machines installed at the selling stations on different parts of the ground will print and deliver tickets and automatically register the bets on a centrally situated adding machine, which, in turn, will cause the figures to appear on the indicator board in full view of the public. One type of indicator is worked on the principle of electric signs, and over 8,000 lamps are used to form the different figures. The "Kathanode" battery supplies the necessary current, besides operating signalling and other devices.

A new portable Ericsson totalisator will shortly be tested on a racecourse near London with a view to getting it approved by the Racecourse Betting Control Board. It is stated that it is the only portable electrical totalisator in the world, and that it involves little preparation for installing. It is not necessary for the frames to be permanently erected, and the only preliminary work is the laying of the cables. The remainder of the apparatus can be moved from course to course.

Lectures on Synthetic Resins.

A course of lectures will be held at the Borough Polytechnic Institute on Wednesdays (7.30 to 8.30 p.m.), commencing January 22nd, on the subject of "Synthetic Resins, Moulding Powders and Plastics. The lecturers are men actively engaged in the manufacture or use of the different types of resins and plastics, and they will deal with the manufacture, properties, uses and future possibilities of the products. The first six lectures will be: Thiourea-formaldehyde Resins, Mr. A. V. Keller, F.C.S.; Phenol-formaldehyde Resins, Mr. H. V. Potter, B.Sc.; Casein Plastics, Mr. R. Dodd, B.Sc.; Nitro-cellulose and Cellulose Acetate Plastics, Mr. J. E. Beard; Methods of Moulding, Moulds and Moulding Machinery, Mr. A. V. Keller, F.C.S.; and Liquid Cements and Binders, Mr. J. Taylor, B.Sc. Dates and lecturers will be announced later for lectures on Coumarone and Indene Resins, Glyptals, Artificial Glass, &c. The fees for the course are 10s. for London students under 18 and £1 for London students over 18. Applications for forms and further particulars should be made to the Principal, Borough Polytechnic Institute, Borough Road, S.E.1.

Appointments Vacant.

Plumber cable jointer and meter tester repairer for Workington Corporation. Engineer for the development of the showroom and use of electricity, for Chester City Council. Chargehand plumber cable-jointer for Eccles Corporation. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting of the Institution on December 9th, a discussion was opened by Messrs. W. R. Rawlings and T. C. Gilbert from opposing points of view on the perennial question of whether "to earth or not to earth." The importance of the subject attracted a very large and representative gathering, and the views expressed showed that the subject, despite the official stipulation, is as moot as ever. Mr. W. E. Bradshaw was in the chair.

Mr. Rawlings entirely agreed that the subject needed the fullest publicity. He felt that the Press notices of the last discussion did a great and valuable service to the industry in bringing home the importance of safeguarding the public against the possible dangers of alternating current at 230 volts. He thought it must all result in a definite call for better materials and workmanship. To insulate was best, but he had still to learn how it could be effectively done. Until motors, cookers, radiators, fans, irons, kettles, &c., could be made of insulating material, he believed there could only be one course, namely, to earth. He was fully aware that the present method of earthing had flaws and was misleading, but he pressed for general and stricter observance of the practice. He advocated earthed concentric wiring as providing a safe system which intimated any leakage by automatically cutting off supply to the affected section.

Mr. T. C. Gilbert said that, if only a fraction of the time and energy spent in advocating the earthing of all exposed metal had been given to the consideration of ways and means of eliminating such metal, they would to-day be in a much sounder position. The earthing idea seemed delightfully simple, but its application to domestic portable apparatus was so remote from good practice that only legislation could enforce it. If after thirty years the practical man was still unconvinced, surely there must be good reason to suspect that the idea was unsound. He agreed that very great harm was done to the industry by electrical accidents, and said that means must be found to reduce the risks in view of the forthcoming universal a.c. supply, but he held that earthing was unworthy of being the sole reply of the industry to the menace confronting unskilled users of electrical apparatus. There were too many weak links in the chain. With universally-earthed equipment it would not be necessary for victims to get into baths, or connect themselves to earth by similar means, as a convenient earth would always be at hand. Recently he found a child poking the metal handle of a toy into the element of a radiator; luckily the latter had not been earthed and so a serious accident was avoided. In the case of some of the newer cookers, it was extremely difficult to obtain a

shock, owing to the thick coating of vitreous enamel with which they were covered. That was a step in the right direction, but there might be very high insulation between the boiling plate and the hob, and he could not repress a shudder when he thought of kettles, &c., used in proximity to that mass of earthed metal. No domestic appliance in use to-day could not be constructed of material other than metal, or, alternatively, could not be effectively insulated.

Dr. A. Ekstrom said that earthing was a very dangerous practice to introduce into houses, because of the false sense of security. If one could not rely on it, one was better without it, while in rural wiring it was very difficult, or impossible, to find an earth of sufficiently low resistance. If only the handles of irons and kettles were better insulated than at present, a very great improvement would be effected. It was also desirable to insulate the knobs of water taps, because they were firmly gripped.

Mr. S. W. Melsom was sorry that the advocates of earthing had confined their proposal to a dubious concentric wiring system. Could anyone doubt that the real solution was to insulate all apparatus? There was too much inclination to neglect the more reliable method of using the very best dielectric.

Mr. F. E. Phillips said that, while tough-rubber-insulated cables originated for use as colliery trailing cables, their use had been extended to all purposes. Government Departments used them largely, and innumerable important buildings had been so wired. Such cables could be exposed to the atmosphere or concealed at will. They withstood moisture and provided the ideal insulated system.

Messrs. C. J. Banister, A. J. Bousfield, W. E. Bradshaw, A. H. Dykes, A. Edwards, H. Willoughby Ellis, A. F. Harmer, B. Higgs, W. E. Lang, A. Morgan, W. A. Ritchie, E. S. Ritter, A. J. Stiling, and D. J. Watkins also spoke.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Sunderland Town Council has appointed Mr. A. B. McLEAN, of Newcastle-on-Tyne, as chief assistant in the Electricity Department, to fill the vacancy caused by the appointment of Mr. W. A. Royle, as borough electrical engineer of Blackburn, at a commencing salary of £700, rising to £800 a year. An amendment to refer the matter back to the Electricity Committee on the ground that the post had not been advertised was defeated.

Capt. J. W. BARBER has been elected chairman of the Radio Manufacturers' Association and Mr. R. M. ELLIS vice-chairman.

Mr. GEORGE TOUGH, O.B.E., M.I.E.E., manager of the Coventry Corporation Electricity Department, is retiring upon superannuation in April next. He was appointed mechanical assistant at the Corporation's electricity works in 1899 and manager in 1908. When he first went to Coventry the station had a capacity of 350 kW with 150 consumers; to-day the capacity is 70,000 kW with 21,291 consumers. Mr. Tough was responsible for the plans and supervision of the erection, specification, and equipment of the new Longford station, which forms part of the national grid scheme and was recently opened.

Mr. R. H. RAWLL, A.M.I.E.E., district installation engineer, Birmingham Corporation Electric Supply Department, has been appointed assistant to Mr. G. Rogers, M.I.E.E., who is in charge of the frequency change-over in Birmingham.

Obituary.—Mr. S. FERRIS.—The death has taken place suddenly, at the age of 65 years, of Mr. Shadrach Ferris, who was in business as an electrical engineer at Swindon. At the age of five years he lost his sight, but after being educated at blind schools at Bath and London, he went to Swindon, attended evening classes at the Technical Institute, and obtained the City and Guilds certificates in electrical engineering. He had resided in the town for about 30 years.

HERR A. V. ZELEWSKI.—The death recently occurred in Berlin, at the age of 53 years, of Herr A. V. Zelewski, the chief engineer of the A.E.G. transformer works. The deceased, who was born in Rome, Italy, was an authority on transformer design and construction, and has left the manuscript of an unfinished book on the subject.

MR. A. J. HUBER.—We hear with regret of the sudden death at Hayes of Mr. A. J. Huber. After severing his Continental associations, Mr. Huber was on the staff of Messrs. Ferranti, Ltd., Hollinwood, which appointment he relinquished in 1920 to join the British Electric Transformer Co., Ltd., taking charge of their export work. Mr. Huber was 51 years of age.

SIR HENRY JACKSON.—The death occurred on Saturday last of Admiral of the Fleet Sir Henry Bradwardine Jackson, who not only rose to high naval rank but was a scientist of considerable attainments. Sir Henry was born in 1855; he entered the Navy at an early age and reached flag rank in 1906. In the meantime he had read a paper before the Royal Society in "Some Phenomena Affecting the Transmission of Electric Waves over the Surface of the Sea," and in 1901 he was elected a Fellow of the Society in recognition of his research and development work in connection with wireless communication. He had met Marconi in 1896 and assisted and supported him in his work, although the Admiralty rejected Marconi's offer of the use of his patents on account of the supposed danger of the ignition of the magazines by wireless waves. He introduced a rudimentary system of radio communication while serving with the Mediterranean Fleet in 1901 and later he developed a more satisfactory arrangement while commanding a torpedo-school ship at Devonport. He continued his activities until his promotion to flag rank and several years after, in 1920, he became chairman of the Radio Research Board, a position which he held until this year. His energies were not, however, devoted solely to radio work; in many other branches of naval science (particularly in torpedo development) he was an acknowledged authority. During the war he held a number of special posts and he was appointed First Sea Lord when Lord Fisher retired in 1915. He held this position for about eighteen months and finally retired from the Navy in 1924. Sir Henry was a

Elliott & Fry [*London.*

The late Admiral of the Fleet Sir Henry Jackson, F.R.S.

Knight Grand Cross of the Order of the Bath and a Knight Commander of the Victorian Order; he held honorary doctorates of Oxford, Cambridge and Leeds Universities; and became an associate member of the Institution of Electrical Engineers in 1883 and had been a member since 1902.

Will.—Mr. J. S. THOMSON, of Dunfermline, manager of the Fife Electric Power Co., left £6,043.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Tom B. Wilkinson, Ltd.—Private company. Registered December 9th. Capital, £100 in £1 shares. Objects:—To carry on the business of electricians, electrical engineers and contractors, mechanical and general engineers, cabinet makers and furniture dealers, workers and dealers in gramophones, wireless sets, &c. The directors are:—O. W. Porritt, Torside, Helmshore, Lancs. (director, Porritts & Spencer, Ltd.), T. B. Wilkinson, Arnside, Westmorland. Registered office:—Arnside, Westmoreland.

Lancashire Electric Sign Construction Co., Ltd.—Private company. Registered December 11th. Capital, £1,000 in £1 shares. Objects: To acquire from W. Donegani, the inventor and patentee, his invention called the "Controlagraph," and to carry on the business of advertising contractors, sign-writers, suppliers of and dealers in electrical, luminous, and other signs, signalling apparatus, and component parts and accessories, &c. The first directors are:—J. F. W. Johnson, 15, King Street, Covent Garden, W.C., manufacturer; H. Walmsley, 476, Edge Lane, Droylesden, Lancs., manufacturer. Qualification, £50. Solicitors: Robert B. Batty & Co., 4, Clarence Street, Manchester.

Wm. E. Culkin & Co., Ltd.—Private company. Registered December 6th. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical, mechanical and automobile engineers, haulage contractors, suppliers and distributors of electricity, proprietors and managers of telegraph, telephone and signalling works, manufacturers of generators, motors, dynamos, lamps, accumulators, radiators, vacuum cleaners, wireless receivers, &c. The first directors are:—F. Sowden, 37, Hampden Street, Bradford, clerk; Edith M. Wood, 117, Camp Road, Leeds, secretary. Qualification, £50. Registered office: Neville Street, Leeds.

Low Pressure Lamps, Ltd.—Private company. Registered December 10th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in low pressure and all other forms of electric, incandescent or other lamps, arc lamps and lighting apparatus of all kinds, &c. The subscribers (each with one share) are: A. L. Howard and P. S. Hicks, 36, New Broad Street, E.C.2, solicitors' clerks. The first directors are not named. Secretary: F. S. Bullard. Registered office: 36, New Broad Street, E.C.2.

Swindon Radio Relay Exchange, Ltd.—Private company. Registered December 12th. Capital, £2,300 in 2,000 shares of £1 each and 6,000 shares of 1s. each. Objects: To construct and maintain wireless signal stations for the reception and distribution of wireless or radio signals or waves, &c. The directors are: J. F. Powell, 34, Wellesley Road, Clacton-on-Sea (director Broadcast Relay Service, Ltd.), A. W. Brown, 80, Goddard Avenue, Swindon, secretary of Co-operative Society; J. W. C. Robinson (managing director), The Cottage, Lancaster Gardens, Clacton-on-Sea (director Broadcast Relay Service, Ltd.). Qualification: £250 shares. Registered office: 14, Victoria Road, Swindon.

Official Returns of Electrical Companies.

Young, Osmond & Young, Ltd.—Capital, £18,000 in 17,500 preference and 500 ordinary shares of £1 each. Return dated August 13th, 1929. 17,500 preference and 45 ordinary shares taken up. £17,545 paid. Mortgages and charges at date of return: £1,500. Since registered: Deposit of deeds dated September 28th, 1929, to secure all moneys, not exceeding £7,000.

John Phillipson & Co., Ltd.—Capital, £500 in £1 shares. Return dated August 14th, 1929. All shares taken up. £500 paid. Mortgages and charges: nil.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Capital, £4,000,000 in £10 shares. Return dated June 12th, 1929. All shares taken up. £4,000,000 paid. Mortgages and charges: £752,400.

Lithanode Co., Ltd.—Capital, £3,000 in £1 shares. Return dated July 10th, 1929. 2,327 shares taken up. £627 paid. £1,700 considered as paid. Mortgages and charges: £2,900.

Wallingford & District Electric Supply Co., Ltd.—Capital, £13,000 in £1 shares. Return dated May 22nd (filed July 12th), 1929. All shares taken up. £13,000 paid. Mortgages and charges: £3,592 6s. 7d.

Pettigrew & Merriman (Continental), Ltd.—Capital, £3,000 in £1 shares. Return dated September 13th, 1929. All shares taken up. £3,000 paid. Mortgages and charges: nil.

Mirrlees, Bickerton & Day, Ltd.—Capital, £600,000 in 100,000 5½ per cent. cumulative preference and 500,000 ordinary shares of £1 each. Return dated July 5th, 1929. 71,000 preference and 466,000 ordinary shares taken up. £302,500 paid on 71,000 preference and 231,500 ordinary shares. £234,500 considered as paid on 234,500 ordinary shares. Mortgages and charges: nil.

Europe & Azores Telegraph Co., Ltd.—Capital, £200,000 in £10 shares. Return dated September 11th, 1929. All shares taken up. £144,320 paid. £55,680 considered as paid. Mortgages and charges: nil.

Ashton Electrical Co. (Preston), Ltd.—Capital, £1,500 in 250 founders' and 1,250 ordinary shares of £1 each. Return dated July 10th, 1929. All shares taken up. £1,350 paid on 1,100 ordinary and 250 founders' shares. £150 considered as paid on 150 ordinary shares. Mortgages and charges: nil.

Dubilier Condenser Co. (1925), Ltd.—Capital, £500,000 in 250,000 preference shares of £1 each and 500,000 ordinary shares of 10s. each. Return dated July 24th, 1929. 200,000 preference and 426,250 ordinary shares taken up. £413,125 paid. Mortgages and charges: nil.

Ridged Cone Co. Ltd.—Particulars filed of £800 debentures authorised November 30th, 1929, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Hewittic Electric Co., Ltd.—Satisfaction in full on October 30th, 1929, of debentures authorised October 27th, and registered November 1st, 1927, securing £10,000.

Garnett, Whiteley & Co., Ltd.—Debenture dated November 29th, 1929, to secure £7,350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: A. K. Bulley, Ness, Neston, Ches.

Electro Dynamic Construction Co., Ltd.—Satisfaction to the extent of £1,600 on November 7th, 1929, of four of a series of six debentures of £250 each, authorised October 22nd, and registered October 28th, 1924.

City Notes.

Burma Electric Supply Co., Ltd.

The annual meeting of this company was held on December 11th, Mr. C. O. Webb (chairman) presiding. In presenting the report and accounts the chairman said that during the past year considerable progress had been made in the change over from 500 V to 250 V. The increase in receipts was due to increased sales and not to the alteration in the rates on the change-over. Regarding the tramway undertaking, the loss on this service was due to the competition of motor-omnibuses. In Mandalay the greater part of the travelling population consisted of poor people to whom cheap fares were a necessity, and it would not be possible to run a regular service of motor-omnibuses in Mandalay at the low fares which were charged on the trams. It was estimated that the motor-omnibuses plying on the routes covered by the tramways were carrying approximately 50 per cent. of the traffic formerly carried by the trams. Regarding the future of the tramways, they were endeavouring to add to the comfort and convenience of passengers as they believed that this method of transport formed the only real solution of the problem of cheap transport. It was hoped that the authorities would eventually realise the

disservice they might be rendering to the travelling public if the present conditions were allowed to continue. The report and accounts were adopted.

Low Temperature Carbonisation, Ltd.

The report for the 15 months ended October 31st, shows that sales and revenue totalled £115,069, and the trading profit amounts to £26,907. Maintenance, research, office and technical expenses absorb £19,990, interest on debenture stock requires £15,000, transfer charges, &c., account for £1,750, and debenture trustees' fees £197 resulting in a net loss of £4,494. The Barugh works has been in constant operation night and day during the whole of the 15 months, the second works at Askern is established, and a third works is being erected at East Greenwich for the South Metropolitan Gas Co. A crude coil oil distillery has been erected at Barugh. The demand for Coalite continues to increase at a greater rate than the supply.

Allen West & Co., Ltd.

The accounts for the year ended July 31st, 1929, show a net profit of £29,291; a balance of £54,175 brought forward is added, making £83,466. It is proposed to place £8,000 to depreciation reserve, to pay an ordinary dividend of 8 per cent., and to carry £61,612 forward. The expenses connected with the issue of 200,000 7 per cent. cumulative preference shares of £1 each in July last are to be written off out of capital reserve. The investment in subsidiary companies was increased during the year from £30,494 to £61,158.

Auto Electric Devices, Ltd.

The first report of the board, covering the period from July 14th, 1928, to September 30th last, says that difficulties with regard to machinery, &c., have arisen to delay the production of the company's self-winding gramophone motors. Inquiries which have been received indicate a good demand for the appliance. Steps have been taken to protect the device in a number of foreign countries. A net profit of £280 is reported.

Baird Television Companies.

It is reported that negotiations are proceeding between the Baird Television Development Co., Ltd., and the Baird International Television Co., Ltd., for an amalgamation of the two concerns. At yesterday's annual meeting, it was to be proposed that the meeting should be adjourned until early in the New Year.

Stock Exchange Notice.

Dealings in the following have been allowed by the Committee under Rule 159:—

Underground Electric Railway Company of London, Limited.—5,313 ordinary shares of £1 each fully paid, Nos. 7,278,273 to 7,283,585.

Manx Electric Railway Co.

The gross receipts for the year ended September 30th were £43,535, and the net receipts £11,838. After meeting debenture interest and sinking fund contribution, and paying a preference dividend of 2 per cent., less tax, for the half-year to September 30th, 1923, £3,492 is carried forward.

International Telephone and Telegraph Corporation.

It is announced that the total net income of the Corporation and its associated companies for the first nine months of the current year amounted to $13,613,805, equal to $2.33 per share. A quarterly dividend of 50 cents has been declared on the capital stock.

British Electric Transformer Co., Ltd.

The directors report that after deducting the balance brought forward from last year the accounts for the first half of the current year show a loss of £5,596. It is stated that in spite of unrestricted competition the factories are now working full time.

Anglo-Argentine Tramways Co., Ltd.

The dividends on the 5½ first preference and 6 per cent. second preference shares have been declared in respect of the half-year ending December 31st.

Lisbon Electric Tramways, Ltd.

An interim dividend of 3 per cent. has been declared, as last year.

Quebec Power Co.

A quarterly dividend of $½ has been declared on the common stock.

German Companies.

The *Electric Light & Power Investment Company*, of Berlin, recommends the payment of a dividend at the rate of 10 per cent. for 1928-29, as in the previous year.

The *Bank for Electrical Values*, of Berlin, which is an investment company associated with the A.E.G. group, reports a net profit of 2,643,000 marks for 1928-29, as against 2,247,000 marks in the previous year. The dividend remains at 10 per cent.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets have started to deal for the first account in the New Year, and the fact that people will not be required to put down any money until January 9th for what they buy now is a factor which makes for greater willingness to invest money that accumulates at this season of the year. So far as speculation is concerned, the spirit of enterprise is still checked by the uncertainties that prevail in regard to the Hatry settlement. On the other hand, the slump in America is definitely over, and revival of confidence, as well as of prices, rolls away one of the principal clouds that had been overhanging Internationals. The American recovery from the effects of the October-November collapses has been a great deal quicker than that on this side. This may be due to the fact that in the United States the slump, which had such serious consequences, brought the American Government into the field. On this side of the Atlantic, the present Administration has failed to provide any practical scheme for unemployment, and to stimulate languid trade.

County of London Electric.

A feature in the market for electricity supply shares is a sharp drop in the price of County of London ordinary, the quotation giving way from 47s. to 41s. 6d., from which it recovered a trifle to 42s. ex rights. The fall is due to the company's offer of ordinary shares at 36s. Holders of old shares were allotted one new in respect of three old. This provided a bonus valued at about 1s. per old share. The board is being criticised for not having taken advantage of the financial conditions that prevailed earlier in the present year, what time the prospect of a bonus would have had a favourable effect upon the price of the shares, whereas to make a new issue under present conditions was to invite the shrinkage in the old shares that has already occurred. County of London ordinary stood at one time this year at 57s. The criticism seems a little unjust, ignoring, as it does, the services that the County directors have rendered to their shareholders.

The price of the new shares, issued at 36s., started at 2s. 6d. premium, but within an hour or so it had advanced to 4s. premium. The difference between the prices of old and new shares is explained by the fact that the latter will receive no dividend until 1931. If the dividend for 1930 is maintained at 10 per cent., this will be equivalent to about 1s. 8d., taking tax at 4s. in the £. There is a good market in the new shares, which are changing hands with considerable freedom.

Electricity Supply Shares.

Other movements in the market for Home Electricity Supply shares have been mostly downward, though the falls are few and insignificant. Bournemouth & Poole gave way to 57s. 6d., partly in sympathy with the heaviness in County of London shares. London Electrics are a little lower at 26s. 6d., Midland Counties eased off to 27s. 6d. Egham & Staines are 1s. down at 33s., the new at 32s. Northamptons lost 6d. at 44s. Isle of Thanet ordinary retain their rise at the latter price. Scottish Power new shares remain at 27s. 6d., and the new Metropolitan Electrics at 5s. premium are a few pence lower than they were a week ago, Midland Counties new also being a trifle down at 1s. premium. Atlas shares are steady at 27s. 6d.; the preference hardened to 23s. 7½d. London Power debenture stock is up a point at 98.

Tax-free Investments.

There are people who like to receive their dividends in what is called tax-free form: that is to say, the company pays the income-tax and makes out the cheques for a net amount. A number of such shares are included in the electrical lists, and in our own catalogues are indicated by an asterisk, amongst these being, for instance, Babcock & Wilcox, Globe Telegraph and Trust ordinary, and Indo-European. Besides these, Adelaide Electric Supply "A" preference shares receive their 5 per cent. dividends free of tax. The price of the shares is 20s. 6d., dividends are due in March and September, and the yield is a shade under 5 per cent. net. Calcutta Electric 5 per cent. preference, with the same dividend dates, stand at 1 1/16, and pay 4¾ per cent. on the money. Lancashire Electric 6 per cent. preference, with June and December dividends, at 27s., pay 4¾ per cent., and Oriental Telephones, on the basis of the last 12 per cent. dividend, at 2 15/16, return 4¼ per cent. on the money. Melbourne Electric Supply ordinary stock, at 173, and in receipt of 10 per cent. dividends, due June and December, pays 5¾ per cent. All these examples receive their dividends tax free. A number of the companies which in pre-war days used to declare their dividends free of tax, have changed over to the less-tax system. It is comparatively rare to find a company, accustomed to deduct tax from dividend payments, altering this system.

Shares on Offer.

Amongst the debenture stocks and bonds on offer may be mentioned a moderate amount of Associated Electrical Industries 4 per cent. mortgage debenture stock at 75, which gives a yield of £5 6s. 6d. per cent.; the interest service on these is very amply covered. The stock is redeemable at any time at 110. The present price carries the half-yearly interest

due on January 1st next. A small amount of Newcastle-on-Tyne Electric 4½ per cent. consolidated first mortgage debenture stock can be bought at 94, this giving the modest return of 4¾ per cent. outright, but 5¼ per cent, taking into account redemption at 100 in 1939. The Company has the right to repay the stock earlier at 105. The interest service is covered more than eight times over by the amount available on last year's profits. Here, also, the price carries a half-yearly interest payment due on January 1st. There is a fair amount of stock on offer in Quebec Power 5 per cent. first mortgage sinking fund registered debenture at 97, which gives a yield of £5 3s. per cent. on the money, and the interest on which is well covered by the last year's profit figures. Atlas Electric & General Trust 5 per cent. debenture can be bought at 95, to pay £5 5s. 3d. per cent. The amount required for annual interest is £30,000, and on last year's figures there was £499,000 profit available to meet it. Perak River Hydro-Electric Power 7 per cent. participating debenture stock can be bought at 105, with February and August interest payments, this yielding £6 13s. 3d. per cent. The interest is payable out of capital during construction. The stock is entitled to a further participation of 2 per cent. non-cumulative dividend, ranking after the preference dividend. The £1 ordinary shares of the Company stand at about 10s., and there is a 5 per cent. guaranteed debenture stock, issued under the Trades Facilities Acts, which stands at 98, the latter carrying an interest payment due on February 1st next.

Telegraphs and Telephones.

After falling back to the neighbourhood of 36, Cables and Wireless "B" ordinary stock recovered to 37½, the "A" ordinary and the 5½ per cent. preference remaining unchanged at 76½ and 96, respectively. Speculative buying is responsible for the strength of the "B" stock, added to which it is said that a certain amount of bear-covering occurred on the part of those who had sold short of the stock during the flatness in Americans. Great Northern Telegraphs are better at 30, and further improvement occurred in Anglo-American preferred stock, the price advancing to 101½ on the fall in the Bank Rate, which had the effect of directing attention to well-secured investment stocks. Marconi Marines hold their substantial gain at 2 7/16. It is announced from Washington that the International Telephone & Telegraph Corporation will pay 400,000 shares to the Radio Corporation for the combination of the business. Apparently legislation will be necessary to permit the merger of the companies. International Telephones are quoted lower at 80, and American Telephone and Telegraph at 230.

Dollar Stocks.

Hydro-Electrics have been a very lively market, falling at one time to 37, as against 42 a week ago, and recovering to the latter price, the quotations being jerked up and down according to New York advices, speculation on this side following the shares, but only to a mild extent. Brazilian Tractions fell 7 to 39, then recovered to 41½. The preference shares are 10 points lower at 140. Montreal Light & Power shares, at 134½, have shed 2. Pennsylvania Power improved to 77. Shawinigan remains about 82½. In the Mexican group, Mexican Light & Power common shares, at 80, are five points higher. Mexican Tramways common are better at 30, and the 5 per cent. bonds at 74. Toronto 4½ per cent. guaranteed debenture is a little better at 94½. Power Corporation of Canada, at 81½, are better on the forthcoming developments in the Dominion. In the foreign division, Tokyo Electric 6 per cents. are dull at 92 ex dividend.

Home Railway Stocks.

The uncertainty that continues to attach to the Government's intentions in regard to the London traffic problem has resulted in a decline of business in the income bonds of the Underground Electric Railways of London. No alteration has occurred in any of the Tube issues. Districts look the cheapest of the group, though it is taken for granted that the Metropolitan will put up its dividend to 4 per cent. in the forthcoming announcement, and this rate, at 62½, would give £6 8s. per cent. on the money. The public require a lot of persuasion nowadays to induce them to take any particular interest in Home Railway stocks, which perhaps is not particularly surprising, in view of the disappointments of the past, and the continued pressure of road competition. London United Tramways preference shares have been changing hands around 4s. 9d. The last business done in the company's 4 per cent. first debenture stock was at 50 some weeks ago. London & Suburban Traction ordinary shares are quoted at 2s. 9d., the preference, as our lists show, being 10s. middle.

Miscellaneous Matters.

Amongst manufacturing shares the price of Callender's has gone back 2s. 6d. to 3⅜. Henley's are 1/16 better at 5 15/16. English Electric ordinary weakened to 5s., showing a fall of 1s. 3d. per share. Business in this section is subdued. Amongst iron, steel and allied shares, Babcock & Wilcox receded to 61s. 3d., and Vickers are dull at 7s. 9d. It is said, however, that Vickers are doing well at the present time, and that anticipation is likely to suffer no disappointment in looking for a repetition of at least the 8 per cent. dividend paid on these shares (of the nominal value of 6s. 8d.) last April. The rubber market remains extremely quiet.

Share List of Electrical Companies.

Home Electricist Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price Dec. 16 1929.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	57/6	—½	5 4 4
Brompton Ordinary	1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary ...	1	8½	8½	26/6	—	5 5 6
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 6
Chelsea	1	8¾	8¾	25/-	—	5 12 0
City of London	1	10	10	32/-	—	4 7 6
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	1½	—	... ...
County of London	1	7	10	42/-xR	—4/-	4 11 0
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref. ...	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation ...	1	11	11	48/3	—	4 11 3
Kensington Ordinary ...	1	8	8	26/-	—	5 7 8
Lancs. Light and Power ...	1	7½	7½	27/-	—	5 11 2
London Electric	1	8½	9	26/6	- 6d.	5 5 8
Metropolitan	1	9	9	37/6	—	4 16 0
do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	6½	27/6	—6d.	4 14 6
Mid. Elec. Power	1	15	8	33/9	—	4 14 10
Newcastle-on-Tyne Ordinary	1	6	6	23/9	—	5 1 1
do. 7% Pref. ...	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref. ...	10	6	6	11	—	5 9 1
North Met. Elec. 6% Pref. ...	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall ...	1	8	8	26/-	—	5 7 8
Scottish Power	1	8	8	29/-	—	5 12 3
South London	1	8½	8½	25/6	—	5 9 10
Urban Ordinary	1	7	7	35/-	—	4 0 0
Westminster Ordinary ...	1	8½	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	23/6	—	6 7 8
Yorkshire Elec.	1	8	8	33/9	—	4 14 10

Home Rails.

Central London Ord. Assented ...	Stock	4	4	71	—	5 12 8
Metropolitan	,	8	8½	62½	—	5 12 0
do. District	,,	4	5	72	—	6 19 0
Underground Electric	£1	5	7	31/6	—	6 10 8
do. do. Income ...	Bonds	6	6	103	—	5 16 6

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101½	+1	5 18 8
do. Def.	,,	1½	1½	24½	—	6 4 5
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½ Pref. ...	Stock	—	—	96	—	5 14 7
do. A 7½ Ord.	,,	—	—	76½	—	... ...
do. B Ord.	,,	—	—	37½	—	... ...
Globe Tel. and T. Ord.	10	10	10	23	—	*4 7 0
do. do. Pref.	10	6	6	10⅝	—	5 9 1
Great Northern Tel.	10	20	17½	80	+1	5 16 8
Indo-European	25	10	10	52½	—	*8 16 2
Marconi-Marine	1	12½	15	2 7/16	—	... ...
Oriental Telephone Ord	1	12	12	2½	—	*4 5 5

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	8¾	—	8 16 0
do. do. 2nd Pref. ...	5	6	6	8½	—	9 12 0
do. do. 6% Deb. ...	Stock	5	5	72½	—	6 18 0
British Electric Traction Def. Ord.	,,	5	5	1525	—	... ...
do. do. Pref. Ord.	,,	8	8	120	—	6 13 4
Brazil Traction	100	7	8	41½	—4½	4 16 5
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	87½	—	5 14 3
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ...
London United Tram Deb. ...	Stock	4	4	51½	—	7 15 4
Mexico Trams, 5% Bonds	—	5	5	74½	+1½	6 15 2
Mexican Light Common	100	Nil	Nil	75	—	... ...
do. 7% Pref.	100	7	7	77½	—	9 0 8
do. 1st Bonds	—	5	5	73½	—	6 16 1
Victoria Falls Ord.	1	15	15	2⅝	—	5 4 2
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	—	25/9	—	4 13 2
Babcock & Wilcox	1	13	15	61/3	—9d.	*4 16 0
British Aluminium Ord.	1	10	10	46/-	—	*4 7 0
British Elec. Transformer Pref. ...	1	7	7	18/-	—	... ...
British Insulated Ord.	1	15	15	3⅝	—⅛	4 2 8
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	1	15	15	3½	—	4 0 0
do. 6½% Pref.	1	6½	6½	1½	—	5 4 6
Crompton Parkinson Ord.	5/-	—	30	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	1	7½	7½	24/6	—	7 1 2
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	7½	5½	15/-	—	7 6 8
Enfield Cable Ord.	1	20	20	4½	—	4 8 0
English Electric	1	Nil	Nil	5/-	—¼	... ...
do. do. Pref.	1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/-	—	5 8 4
do. Ord.	1	10	10	2⅜	—	4 4 5
Henley	1	25	20	5 15/16	+1/16	5 1 0
do. 4½% Pref.	6	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	10	—	36/3	—	5 10 3
Siemens Ord.	1	7½	7½	26/3	—	5 14 3
Telegraph Construction	12	10	10	23	—	*5 4 2

*Dividends paid free of Income Tax.

Brazil's Electrical Imports.

Share of Leading Countries.

THE Brazilian Government, possibly owing to the visit of the d'Abernon Mission, has published statistics for 1928, compared with previous years, of the foreign trade of Brazil in certain leading items among imports and exports. The electrical business is dealt with in considerably greater detail than has been the case for some years, and we are able to give below tabular statements showing the weight and value of imports in 1927 and 1928, based on the classification of the Brazilian Customs, distinguishing the chief countries of origin of the leading lines of electrical goods :—

BRAZILIAN IMPORTS OF MACHINERY FOR ELECTRICITY AND ELECTRIC LIGHT.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	5,217	1,063	6,129	1,247
From Great Britain ...	759	173	782	171
,, United States ...	2,162	531	2,915	637
,, Germany ...	1,183	177	1,601	250
,, Italy	501	70	238	40
,, France	161	139	153	37
,, Belgium ...	179	16	126	16

It will be seen that Great Britain's share of the total value of imports was, in 1927, 16 per cent., and in 1928 nearly 14 per cent., while that of the United States was 50 per cent. and 51 per cent., respectively, and of Germany 16.5 per cent. and 20 per cent., respectively.

ELECTRIC DYNAMOS AND GENERATORS.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	1,345	194	1,065	172
From Great Britain...	70	15	130	32
,, Germany ...	373	44	505	61
,, United States ...	610	97	237	57
,, Switzerland ...	186	25	107	12

It is noteworthy that Germany's share in the total value of the trade last year was the largest, *viz.*, 35 per cent., as compared with only 22 per cent. in 1927, thus taking the place occupied in 1927 by the United States, which then accounted for 50 per cent. of the trade. Great Britain's proportion was 18 per cent. in 1928, and only 7.5 per cent. in 1927.

ELECTRIC MOTORS.

	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	1,605	244	1,690	251
From Great Britain...	205	35	212	37
,, United States ...	494	93	475	88
,, Germany ...	379	50	440	59
,, Belgium ...	78	8	185	17
,, Sweden ...	107	12	112	13
,, Italy	121	14	104	13

The United States has the largest share in this business, probably due mainly to the supply of traction motors to Rio de Janeiro, its proportion of the total value being 38 per cent. in 1927 and 35 per cent. in 1928, while Great Britain's share remained at about 14 per cent. Germany was an important supplier, securing nearly a quarter of the total trade.

ELECTRIC TRANSFORMERS.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	1,526	202	1,717	207
From Great Britain...	261	36	173	17
,, United States ...	759	107	948	128
,, Germany ...	265	28	361	38
,, Sweden	17	2	64	6

Great Britain's participation in this trade compares unfavourably with that of either the United States or Germany, the percentages in 1927 and 1928 of these three countries, respectively, being :—18 and 8; 53 and 62; and 13.5 and 18.5.

ELECTRIC CABLES.

	1927		1928	
	Tons.	£ (Thous.)	Tons.	£ (Thous.)
Total ...	2,937	202	2,802	182
From Great Britain...	928	54	1,299	70
,, United States ...	532	55	359	35
,, Belgium ...	193	15	231	18
,, Germany ...	528	28	289	18
,, Italy	520	29	226	11

There was also, in 1928, an import of these goods from Canada of 317 tons, value £28,000. While Great Britain's share in the value of this trade rose from 27.5 per cent. in 1927 to nearly 40 per cent. in 1928, that of the United States fell from 28.5 per cent. to 19.5 per cent., and that of Belgium rose from 7 per cent. to 10 per cent, while the shares of Germany and Italy decreased.

Batteries on Board Ship.

Points of Interest in Connection with a New Development in the use of "Exide Ironclad" Accumulators.

By A. C. Hardy, B.Sc., A.M.Inst.N.A.

ONE of the most striking phases in marine engineering technique during the past ten years has been the ever-increasing use to which electricity is being put on shipboard, and in particular the use which is now being found for electric accumulators.

Batteries, of course, and in particular the type which is made by the Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester, are not strangers to sea use, because for many years "Exide Ironclad" batteries have been fitted to British submarines of all sizes for propulsion under water.

Storage batteries, apart from their use in submarines, until comparatively recently have been largely connected with such relatively auxiliary matters as wireless telegraphy, and the supplying of light to certain limited portions of the decks in passenger ships in the event of the main power source failing.

To-day, however, there are available batteries which can take over the whole of the steering of the ship, should the main power plant give out, supply power for handling the boats, and, in conjunction with the deck auxiliary generating set, can act as an auxiliary engine room on deck, whereby winches, windlass, deck lights, navigation lights, boat-lowering gear, and steering gear can be operated if the main engine room is entirely flooded.

There is, too, another function of the battery which has only recently begun to attract the attention of owners of coastwise shipping. This may perhaps be best illustrated by taking a particular case of a ship carrying steel plates on the Great Lakes of North America. This ship is not large, but is of a type usually known in Europe as a coaster. Her cargo capacity is just over 2,000 tons, and she has a total of 750 h.p. for propelling her at about 9 knots. The whole of the auxiliary installation of the ship is electrically driven, there being for this purpose two 90-h.p. airless injection Diesel engines, each coupled to a 60-kW 240-volt compound-wound generator. For cargo handling there are two 5-ton cranes, each driven by a 65-h.p. electric motor. As originally completed the ship had no battery installation, and it was found that when both cranes were working at once a considerable overload resulted, particularly as the stevedores showed a tendency to run the hoists on one or two points of the starting handles. This peak load caused the running of the auxiliary generator sets to be far from satisfactory.

Two banks of "Exide Ironclad" cells have now been installed in this ship, with the result that during unloading operations at the present time one generator set can be cut out completely, with a corresponding saving in fuel.

During peak loads the batteries feed into the line, preventing the over loading of the generator, and when any particular load has been hoisted the generators charge the batteries. The generator engine thus operates at a constant speed without over-loading.

The manufacturers of "Exide" batteries contend that what is possible with a ship of this type under such severe conditions of unloading, should be very definitely possible on smaller types of cargo vessels, and to-day they have come into the market with a range of batteries suitable for practically every type of marine work.

The Chloride Company has been connected with marine battery manufacture for some 30 years, and has made a special study of the problems relating to their application on board ship. The "Exide Ironclad" battery is specially designed to operate successfully under conditions involving heavy electrical discharges, mechanical vibration, and swirling of the electrolyte. The principle upon which the cells are built up precludes any growth of buckling of the plates, assures low internal resistance, and permits of very high discharge currents without undue drop in voltage.

The active material of the positive plate is enclosed in slotted ebonite tubes, and is thus held securely in contact with the grid which conducts the current to the terminals. The slotting of the ebonite is of a fine nature, and in consequence the electrolyte is allowed free diffusion to the active material, whereas the latter cannot fall away from the tube. The negative plate consists of a hard alloy grid with a lattice structure, forming a flat cage which holds the active material in the form of continuous strips. This method of construction results in low internal resistance, and renders the plate unaffected by vibration or other mechanical stresses. Special durable wood separators are arranged between the plates in cells, and these are subjected to a process which eliminates elements injurious to the batteries.

A Large Supply Control System.

Notes on the Control Centre at Ergon House of the London Power Co., Ltd.

THE control of a system such as that of the London Power Co., Ltd., necessarily involves for its effective operation the collection of a considerable amount of data with regard to the frequent changes in the climatic conditions, as the area supplied is very sensitive to the intensity of the light or the degree of visibility and to the atmospheric temperature.

By observing the daily actual load demand at or about 8 a.m., and after studying the weather conditions, the control engineer, by means of the use of functional constants or by reference to specially prepared curves, is able to establish an estimate of the morning peak load. With this estimate in front of him he allocates the anticipated total load to the various generating stations, and therefore at or about the hour named each station is informed as to what proportion it will be expected to meet at the morning peak, is instructed as to what plant to have on line, and also as to the amount of power to be held in reserve. The same procedure takes place at or about 2 p.m. in connection with the evening peak load.

The Ergon House Control Room.

In order to ensure conditions of greatest possible safety, not only to individuals, but also to the system generally, no switching operations are allowed without the consent of the control engineer nor can work be undertaken or commenced on any e.h.p. apparatus until he has sanctioned the issue of a "permit-to-work" card. Very exacting general regulations have been issued, covering the operations and maintenance of e.h.p. cables, switchgear, and all other equipment, and special instructions have been issued to cover conditions arising when a state of emergency exists, so that the control engineers may be confident that their instructions will receive immediate attention.

The control of the 22,000-volt interconnected system of the London Power Co. is directed from Ergon House, where one or more control engineers are always on duty. The control room is approximately 35 ft. square, is well provided with natural light, and occupies a position in the building which renders it quiet and free from noises likely to distract the attention of its occupants. The control of the whole of the system of the Power Company is effected largely through the medium of a suitably planned and efficient system of telephonic communication between the control centre, generating stations, switching stations and all the principal sub-stations connected to the system. Approximately in the centre of the room is the control desk, which may be conveniently divided into three sections—left, centre and right. The centre portion is designated the control switchboard, and is flanked on either side by control desks equipped with telephones by means of which any point of the system can be communicated with. Immediately facing the control desk at a distance of some 13 ft. is a steel structure, also conveniently divided into three sections. The left wing or instrument panel is equipped with instruments for indicating the following particulars from each generating station: operating steam pressure of the boilers; total instantaneous output of the station; voltage obtaining at the station; and the frequency of the supply from the generators.

This information is transmitted automatically from each generating station to the instruments on the aforesaid instrument panel in the control room by means of pilot wires laid between the generating stations and Ergon House, so that the indications on the master instruments in the generating stations are faithfully reproduced on the instruments in the control room Immediately at the top of this wing is a voltmeter, indicating the voltage of the interconnected system. By means of a multiway switch the voltage obtaining at any one of the generating stations can be indicated on this instrument. At the bottom of the panel is the frequency indicator of the system.

The centre or system-diagram panel is composed of ¼-in. thick steel plate specially treated with a cellulose paint of such a shade as to be restful to the eyes. All the feeders and interconnecting cables between the generating stations, switching stations and distributing stations are depicted by monel metal strips. This diagram indicates to the control engineers in what manner the system is electrically coupled, and the "in" or "out" position of every switch on the system. The switches at every generating station, switching station and distributing station are represented on the diagram by small "light windows," and by means of a special system of lighting a green light or red light appears in the window, depending upon whether the switch at that point is switched "out" or "in." No light appearing in the window indicates that the particular switch is out of commission and is isolated.

The illumination of the "light windows" representing switches on the system is controlled from the centre portion

of the control desk by means of miniature switches which are operated by the control engineers.

The control engineer, by means of the telephone, communicates with a responsible person at the point at which he requires an alteration to the switching conditions made. On the completion of the operation he then "dresses the board," *i.e.*, by means of the miniature switches on the control switchboard, he repeates the operation he directed to be carried cut, thus reproducing on the "mimic" diagram the altered conditions of the switching at the point in question. Every "light window" representing a switch on the mimic diagram has a corresponding miniature switch on the control switchboard, each switch being provided with a coloured handle conforming to a colour scheme which has been introduced in order to facilitate the dressing of the system diagram, so that in effect the control switchboard is a check upon the diagram.

A "plant panel" at the bottom of the diagram panel is provided with a "light window" for every boiler and generator installed at each of the generating stations. The illumination of these "light windows" is also controlled by the control engineers, and is based on information obtained from time to time from the several generating stations. They are thus enabled at any time to observe at a glance the following particulars obtaining at each generating station: boilers steaming; boilers in reserve; boilers out of commission; generators on line; generators in reserve; and generators out of commission.

Every boiler and generator is numbered and has its own corresponding "light window." A red light in the window indicates that the boiler or generator, as the case may be, is, in the case of a boiler, steaming; or, in the case of a generator, on line. A green light in the "light window" indicates that the boiler or generator is held in reserve, while non-illumination indicates that the plant is out of commission.

Immediately above the centre panel is placed a kilowatt indicator, and it is on this instrument that the total instantaneous load on the whole 50-cycle system of the company is indicated, the readings of the individual station output instruments being summated. In the centre of the lower panel below the system diagram there is inserted a cyclometer upon which is indicated the total output capacity of the generators connected to the system, so that by deducting therefrom the reading of the kilowatt indicator the amount of reserve output is immediately obtained.

The right wing is at present unequipped, but is held in reserve for the accommodatoin of any instruments which may be necessary for indicating the load and other electrical conditions obtaining at the several points of connection between the Power Company's system and the grid or other lines of the Central Electricity Board.

On the right hand wall of the control room there is a case containing a swinging pendulum and three dials. This piece of apparatus constitutes the device for maintaining standard "frequency" over the whole system. The frequency control system was described in our issue of November 22nd, 1929, p. 1920.

In designing the present "control," emphasis has been laid on the desirability of maintaining personal contact between the control engineers and the personnel at the various power houses, switching stations and sub-stations, with the resulting establishment of a desirable team-work spirit. For this reason the employment of automatic indications has been kept down to a reasonable minimum, consistent with the foregoing requirements and the avoidance of the use of complicated transmitting and recording instruments.

The B.I.C. Wire Mills.

A Note on some of the Plant Recently Installed.

THE policy of Messrs. British Insulated Cables, Ltd., is, we are informed, to introduce up-to-date machines in every process, from the casting of the wire-bars to the drawing of the finest wire, as soon as occasion demands. Thus, the new refinery, where copper scrap is turned back into the required form of ingots, is equipped with three oil-fired melting furnaces, and air heaters of the latest pattern are being fitted, thereby capturing much of the waste heat and returning it to the furnaces. The latest labour-saving type of horizontal baling press, with a receiving box at floor level, which self-ejects an almost solid bale, is now being erected. In addition, an ingenious form of electrical reversing planing machine, with double table, has recently been installed for trimming the copper ingots.

The new rolling mill, which rolls the copper bars down to ¼-in. diameter rod for drawing into wire, is driven by a 1,226-h.p. motor. The wire-bars are loaded in the warehouse on to roller-bearing trucks, which carry them to the back of the reheating furnaces, where an electric elevator brings them into position for the electrical pusher to push them through the furnaces. The heated bars fall on a live roller table at the other end of the furnace, where they are self-conveyed through the first pass of the roughing mill. After this a certain amount of hand-tonging is necessary, but as the rod passes through the intermediate and finishing rolls automatic repeaters come into action, and the ¼-in. rod finally passes through pipe guides to the winders, where it is coiled up and dropped on to a conveyor for transfer to the pickling plant. During the annual shut-down for repairs this year, several structural alterations were made in order to deal with copper bars 78 per cent. heavier than was those at present rolled.

The pickling plant has recently been re-designed to speed up and improve the operation. The pickling acid is circulated through an electrolytic depositing plant (recently reconstructed) which extracts the copper from the solution in a convenient form for melting, and re-conditions the acid. The pickled rod is at present conveyed to the wire-drawing machines on electric trucks, but a semi-automatic conveyor system is shortly to be introduced.

In the wire-drawing shop the new machines are fed continuously, one rod being electrically welded on to the next before passing through the machine. This shop also contains the new machines for drawing aluminium wire specially for the British grid scheme. The general principle of construction is the same as that of the copper machines, but in detail the drawing of aluminium presents many difficulties, which can only be overcome by the introduction of special "gadgets."

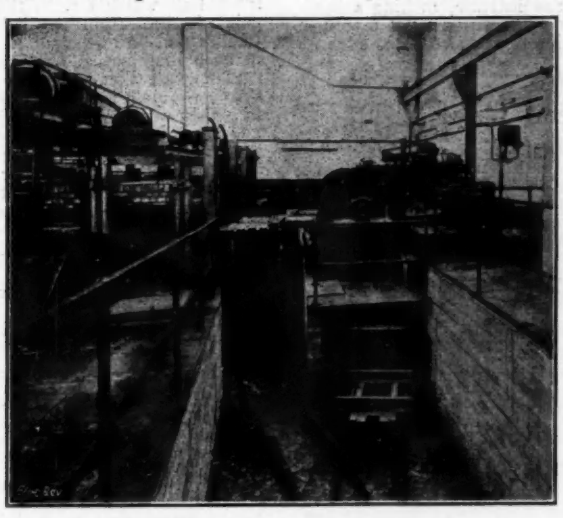


Fig. 1.—Charging Plant for Re-heating Furnace.

It has been necessary to extend the sheet mill to nearly double its original size. The high standard of finish obtained can be best described by stating that copper sheets for photo-engraving purposes are produced, and aluminium sheets are supplied to motor manufacturers of high repute, machine-cut gears being used for driving the rolls. Amongst recent additions to the plant are guillotine shears to cut 10 ft. at one stroke, and a blanking press to cut circles up to 16 in. in diameter.

Transport between the various sections, and also in the packing and export section, is carried out almost entirely by electric battery trucks. Over 20,000 tons of copper is dispatched annually, in addition to aluminium and various alloys.

A new departure is the drawing of "Copperweld" wire, a bi-metal, consisting of a steel core completely covered with copper, for use where strength and non-rusting properties are most important.

Although the test room is already provided with every instrument required for accurate mechanical and electrical tests, orders have been placed for further machinery of special construction, whereby the human element is eliminated as far as possible. These machines are particularly adapted for the weaker materials, such as aluminium and very fine copper wires, with which a slight error of movement on the part of the tester would have an appreciable effect on the tests carried out. New technical offices have also been built.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A New Gate-end Loader.

The new troughed-belt coal loader, fig. 1, being introduced by Messrs. MAVOR & COULSON, LTD., 47, Broad Street, Mile End, Glasgow, S.E., embodies some new and interesting features. Lightness and portability are combined with a rigid and stable structure, thus overcoming difficulties experienced with many gate-end loaders. Inverted steel troughing forms a continuous platform for support of the troughing idlers and a housing for the return belt and its idlers. The inverted troughing extends the whole length of the loader, forming a light but rigid structure to carry the idlers for the top and bottom sides of the belt. By this structure the troughing idlers can be adjusted to ensure true running of the belt, and the return side is completely protected against the possibility of any spillage falling on it; spillage of coal on the return belt, one of the chief causes of trouble with flat belt conveyors, is thus entirely prevented No side plates to keep coal from rolling off or guide pulleys to make the belt run straight are required. The troughed form of belt enables large lumps to be handled with security, and gives so great a capacity that the 26-in. belt can convey 125 tons per hour. The loader is light in weight and easily flitted back from the face to allow the rippers to work, the large diameter wheels running smoothly along the ordinary tub rails. The height of the receiving end above the floor is unusually low for a belt loader, an important feature in thin seams. The receiving end is joined to the structure by a hinge, and when flitting the end lifts; when the loader is again placed in position at the face the receiving end drops on to the floor, and is immediately ready for use without re-adjusting the belt tension. Rollers are provided to support the ends of the shaker conveyors, and apron plates feed the coal on to the belt. The tail pulley gear is completely encased, so that it cannot be jammed by small coal. Tension is applied at the slack side of the driving drum by screws, which are readily accessible and easily adjustable, although out of the way of injury. The belt has a large lap around the driving drum. The drum is driven by a bush roller chain, the sprockets providing means of altering the belt speed should the loader be required for greatly changed duty. The patent driving unit consists of worm reduction gearing, totally enclosed and running in oil; the worm is mounted on an extension of the motor shaft, and the motor or turbine is bolted direct to the structure of the gearcase, making a compact self-contained unit. The driving gear, being mounted centrally under the inclined portion of the structure, adds to

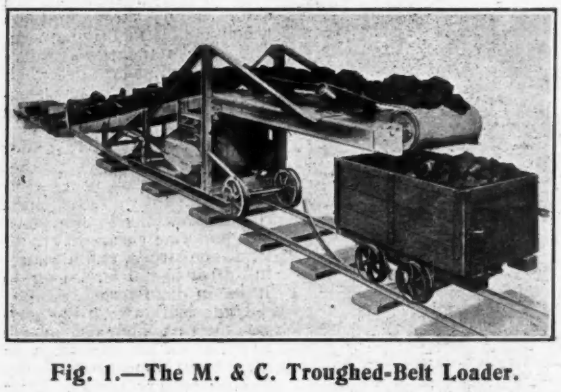


Fig. 1.—The M. & C. Troughed-Belt Loader.

the stability of the loader, and at the same time protects the gear from damage. The loader is controlled from the end of the jib, either by a rod which operates the electric starter or by a cock which regulates the air supply. Face conveyors may also be controlled by the man at the loading point. If electric, a three-panel switchboard may be mounted on the side of the loader, and operated by rods from the discharging end of the jib.

Hotel-fire Charge Collectors.

A development of the "Utility" hotel-fire charge collector recently introduced by ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10, and described in our issue of November 15th last, p. 874, provides for the automatic switching off of any number of collectors in a hotel by means of a master time switch. A solenoid on the trip coil of each collector is energised by the time switch at any pre-determined time, and by this means all the collectors are tripped simultaneously. It is suggested that about 4 a.m. would be a convenient time for the operation of the time switch, but in the case of illness a collector could easily be disconnected.

A Special Flood-lighting Appliance.

Among the new and interesting lines described in the catalogue No. 1,100 published by BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17, the

Fig. 2.—The " Projectolux " Flood-lighting Unit.

"Projectolux," fig. 2, is worthy of special mention. This is a specially designed lighting unit for use wherever light will strike the surface to be illuminated at an acute or grazing angle—the sort of lighting which is necessary when the light source cannot be mounted directly above horizontal surfaces or straight out from vertical surfaces. The powerful floodlight beam which is projected by the special internal chromium-plated reflector is flattened and broadened out by a special front lens which directs the greater part of the light to a point farthest from the light source and a correspondingly smaller portion to the points nearer the reflector. This results in even illumination over the entire vertical surface. Many uses suggest themselves for this particular reflector, and a simple example is the body construction or body painting shop in a motor-car factory, in which it is necessary to get a good intensity of illumination on the curve of the lower portion of the bodies. The unit is designed for use with a 300-watt lamp, is capable of being tilted or rotated at any angle, is vapour proof, and is wired with 6 ft. of special asbestos-covered wire ready for connecting by means of an ordinary plug-and-socket or plug-and-lampholder connection.

A Small Portable Printing Press.

The " SLOGANPRESS " COMPANY, 83, Farringdon Street, E.C.4, has brought to our notice a printing press which would appear to be a distinctly useful piece of apparatus in all businesses that advertise, particularly for such matters as overprinting agents' names and addresses, and printing slogans on letter paper or envelopes. Ordinary printers' type is used, and the overall dimensions of the machine are 8 in. by 5½ in. by 7 in. To print, all that is necessary is to bring forward a handle.

A New Bell Push.

The " Tell-Tale " bell push recently introduced by the RUNBAKEN MAGNETO CO., Tipping Street, Ardwick, Manchester, incorporates a small electric lamp which glows when the bell circuit is completed, thus indicating that the bell at the other end of the line is operating, or at least that it is receiving the necessary operating current correctly.

An Electric Car-Radiator Heater.

The latest addition to the numerous heating devices intended to be used in private motor garages during the winter months in order to keep the temperature of the water in the radiators and engine jackets of cars above the freezing point, is the " Everwarm " which has just been put on the market by Messrs. WHITEHOUSE, WILLETTS & BENNION, LTD., Rex Works, Tything, Worcester. The new heater is of such a shape to entirely cover the front of the radiator, and is intended to be hung from the filler cap; it embodies two electric heating elements, one of which becomes " live " when the

flexible lead is plugged in to a source of electricity supply, the second one being controlled by a separate switch directly mounted on the heater. The "Everwarm," fig. 3, is made in two sizes, one with two 300-watt elements for commercial vehicles and for cars over 16 h.p., and one with a pair of 125-watt elements for vehicles under 16 h.p. The makers claim that the heat of one element will prevent the radiator water from

Fig. 3.—The "Everwarm" Car Radiator Heater.

falling below a temperature of 30 deg. F., while on frosty nights when a lower temperature may be reached, the use of both elements is recommended.

New Bakelite Accessories.

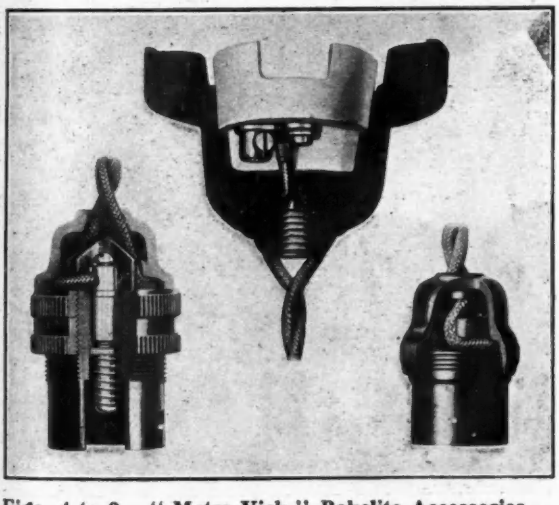
The accompanying illustrations, figs. 4 to 6, depict bakelite accessories recently introduced by METRO-VICK SUPPLIES, Trafford Park, Manchester.

The new M-V bakelite ceiling rose, fig. 5, is made in the popular size of 2¼ in. diameter in both two- and three-way in either brown or cream. There are few parts, a fact which accounts for easy and quick wiring. The appliance is light, but mechanically strong, and breakages both in transit and use are, it is claimed, negligible.

The new M-V lampholder, fig. 4, is of universal application, as it will take, it is claimed, all flexibles. The mouldings are robust, and are made to fine limits to ensure interchangeability. "Emvee" plungers are employed, while, "Mycrome" alloy springs overcome the disadvantage of softening springs while under heat, as the following extract from a N.P.L. report attests:—

"Mycrome" springs, after being subject to a temperature of 200 C. for 48 hours, slightly increased in tension.

The Metro-Vick bakelite adaptor, fig. 6, is unique in having a cordgrip of universal application. It entirely eliminates



Figs. 4 to 6.—"Metro-Vick" Bakelite Accessories.

strain of the conductors on terminal screws, an essential feature for every specification where safety and security for the user is required. For a.c. currents it is claimed to be an indispensable unit.

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2, has just added to its "Magnet" bakelite range of electric lighting appliances a detachable ceiling rose, fig. 7. This ceiling rose, which has a 2¼-in. base diameter, with two fixing holes at 2-in. centres, is so designed as to be suitable for mounting directly to conduit boxes of B.S.S. The advantage of installing this plug-in or detachable-type ceiling rose should more than compensate for the slight extra initial cost, particularly in mills, factories and works where colour-washing or painting of ceilings and walls must be carried out at frequent periods to comply with appropriate regulations. With the ordinary type of fixed-pattern ceiling rose, pendants can only be removed by disconnecting at the ceiling point and rewiring for replacement. With this new ceiling rose it is only necessary to unscrew the clamping ring and withdraw the two-pin plug, replacement being carried out with equal facility. The disconnection of pendants during renovations enables shades or reflectors and lamps to be cleaned at the bench, and their removal during such periods prevents their being

Fig. 7.—The "Magnet" Detachable Ceiling Rose.

smothered with whitewash, &c., with the saving of consequent labour in cleaning off afterwards. Also in the initial stage of installation the pendants can be wired up at the bench instead of at the ceiling point, a time-saving advantage which is obvious.

Coincident with this ceiling rose the G.E.C. has introduced a three-hook suspension plate for ceiling roses, for earthing metal parts of bowl pendants. This suspension plate has been designed for the purpose of connecting the metal work of any three-chain suspenson pendant bowl fitting directly to the conduit box, thus ensuring earth continuity. The plate is intended for fixing between the ceiling rose and conduit box. Any type of ceiling rose can be used in conjunction with the plate, but the facility with which a bowl fitting can be removed, together with the lamp pendant, when renovations are in progress, will, it is claimed, appeal particularly to installations and maintenance engineers when associated with the ceiling roses described above.

A Cable-bonding Mould.

Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1, have just introduced a handy little time

Figs. 8 and 9.—The "Henley" Bonding Mould in Position, and a Bonded Cable.

saver for making soldered bonds on the lead sheathing of cables. It requires no expert knowledge to use and produces, it is claimed, thoroughly effective bonds. This device, known as the "Henley" bonding mould, is shown in the accompanying illustrations, figs. 8 and 9, and the following brief instructions explain how it is used. Scrape a bright patch on the lead sheathing—fasten the mould and earthing strand in position, using the chain fastener, and tighten by means of the milled edge nut. Sprinkle a pinch of powdered resin on the strand and lead through the circular opening in top of the mould and then fill up with solder. To remove the mould after cooling, slack back the nut and unhook chain. Three sizes are made to suit the following cable diameters, measured over the lead sheathing:—

Above 0.945 up to 1.22 in., 24 to 31 mm.
Above 1.22 up to 2.008 in., 31 to 51 mm.
Above 2.008 up to 3.11 in., 51 to 79 mm.

A Kinema Lighting Scheme.

Some Notes on the Installation at the new "Commodore" Theatre, Hammersmith.

WHAT is claimed to be one of the most notable lighting installations of recent years is that at the "Commodore," Hammersmith, for which the General Electric Co., Ltd., supplied the lamps and lighting appliances. The ivory terra-cotta front of the building is eminently suitable for flood-lighting purposes, since the absorption coefficient is low, and a large amount of reflected light is therefore assured at all times. The twin floodlights for the upward

Fig. 1.—Auditorium Centre Unit; 12 ft. Diameter.

and downward lighting of the front of the building are of special design, fashioned on the "Tivoli" lines, and finished in gilt. The canopy is also illuminated in an attractive manner to give a flood of light to the main entrance. In addition to the twin floods, each equipped with 500-watt lamps for upward flooding and 200-watt lamps for downward lighting, there have been installed ten "Gecoray" silvered-glass flood projectors of an entirely new type. These are mounted over the canopy to illuminate the face of the building, and are equipped with 500-watt lamps.

Inside the theatre the main hall, or vestibule, is very well lighted by a number of specially-designed panelled-glass fittings, which incorporate some excellent examples of choice metal work, and are supported by means of silk cord suspensions. To the right and left of the entrance hall are small waiting rooms, illuminated by specially designed boat-shaped lighting units somewhat similar in design to those in the main hall.

In the auditorium, which is practically rectangular, with a gentle curve from the front of the stalls to the proscenium, the illumination is contrived by means of a central pendant 12 ft. in diameter, fig. 1, suspended from the auditorium roof, and a number of specially-designed under-gallery units of pleasing proportions. The large central unit is of special design. Over four thousand lamps, ranging from 10 to 1,500 watts each, are installed throughout the building. The large central fitting is glazed with a special form of diffusing glass made under an entirely new process. One very pleasing feature of this is the gilt edging of the glazing, as when the unit is illuminated it harmonises completely with the general decorative scheme of the roof and the auditorium.

The under-balcony units are of two types, the main central units being circular, and some 6 ft. in diameter. These are flanked by two oval units measuring some 5 ft. long by 2 ft. 6 in. wide, of somewhat similar design. This lighting is augmented by some 60 attractive demi-coupe wall brackets, also of special design, attached to the surrounding walls and pillars; these are glazed with specially tinted glassware.

The forward part of the building is of a semi-atmospheric nature, and houses a number of recessed Italian alcoves, painted with woodland scenery, flowers, foliage, and landscape views. These are beautifully illuminated by means of carefully concealed floodlighting units in batten form, and since these scenes are seemingly detached from the general decorative scheme of the hall, the effect is one of a very pleasing nature. Over the balcony is a large number of demi-coupe wall fittings. The lighting from these is enhanced by a number of charmingly-designed standards accommodating miniature water fountains illuminated by a number of colour-sprayed lamps. The whole of the auditorium lighting is dimmer-controlled by means of a single-tier dimmer bank, with six levers and individual and master control and detachable slow-motion drive. It controls 12 Schwabe 100-contact dimmers, which are operated in pairs.

For stage-lighting purposes a type C footlight, some 42 ft. long, is employed. This is fitted with silvered-glass reflectors. The lighting is arranged in four colours, and each colour is sub-divided into three sections, centre, right and left. Four 42-ft. type D battens, fig. 2, also equipped with silvered-glass reflectors, are employed. A special type of footlight, 16 ft. long, with stainless-steel reflectors, designed for vertical burning, and provided with bearings for tilting at various angles, is installed at the rear of the stage for illuminating the bottoms of back-cloths, &c. This takes the place of the usual ground rows. Two S.L. 400 stage spotlights are installed for the perches. The footlights and battens are of extra-solid construction, and are built for lasting and durable service. Two entirely new design front-of-house magazine-type arc projectors, and one improved model 100-A projector, are installed, the latter model being equipped with a number of accessories and projection attachments for special-effect purposes and lantern slides. These new projectors have the merit of being of British manufacture throughout, and are far more simple to operate than some of their complicated prototypes that emanate from abroad.

The stage lighting is controlled by a G.E.C.-Schwabe four-tier dimmer regulator, which is ingeniously contrived. Each tier comprise fours levers, complete with individual and master controls and detachable slow-motion control. It is fitted also with grand master control levers and wheels with a slow-motion worm-gear device, which permits of an extraordinarily wide range of colour gradations. This particular

Fig. 2.—Type D Stage Battens; 42 ft. Long.

form of regulator is the first of its kind to be installed in a London theatre, and controls some 48 Schwabe 100-contact dimmers.

The lighting fittings were designed by Mr. Felix B. O'Hanlon, A.M.I.E.E., the consulting engineer to the theatre proprietors.

Car Battery Standardisation in France.

The Standardisation Committee of the French Association of Motor Accessory Manufacturers has, since its formation in 1927, devoted special attention to the reduction of the number of different sizes and shapes of batteries used in connection with the electric lighting and starting installations on motor vehicles, and has succeeded in reducing the number from 120 to seven, four for 6 volts and three for 12 volts.

A Norwegian Hydro-electric Station.

Brief particulars of some transformers which are said to be amongst the largest constructed in Scandinavia.

THE Nore power station, a large electrical undertaking recently completed for the Norwegian Government, is situated in Numedal, about 60 miles from Kongsberg at the terminus of the Kongsberg-Rodberg railway. Water is supplied to the station from the small Tunhoyd Lake, which is so situated that it has been possible by the construction of a dam to impound about 12,000,000,000 cu. ft. of water with an available head of about 1,150 ft. The initial development of the station includes four sets, each consisting of a Pelton horizontal turbine of 36,600 h.p. at a net head of 1,000 ft., running at 300 r.p.m. and directly coupled to a three-phase generator of 25,400/29,000 kVA at 11,000-12,000 volts, 50 cycles. Each generator is connected to high-voltage busbars through a 12,000/144,000-volt transformer of equivalent size, and between the generators and transformers only isolating switches ahe used, so that synchronisation must be carried out by the oil switches on the 144,000-volt side. When fully developed the station will contain eight similar sets, while plans have been prepared for the construction of another station, Nore II, which will take water from the tail race of the first plant.

The power from Nore is transmitted at a pressure of 132,000 volts to three sub-stations at Flesaker, between Drammen and Kongsberg; at Smestad, in the neighbourhood of Oslo; and at Slagen, near Tonsberg. Through the sub-stations the Nore station can be connected in parallel with other power systems supplying those districts. When the scheme is completed two double transmission lines will run from Nore, one direct to Smestad and the other to Flesaker and on to Slagen. To begin with the lines are single circuits, but they have a fourth wire as a stand-by. The distance from Nore to Flesaker is approximately 50 miles, and from Nore to Smestad 70 miles. At intervals of about 12 miles switching stations have been constructed where the lines are "rotated." At those stations also the reserve conductor can be connected in circuit in place of any of the three-phase lines, should a breakdown occur.

The four transformers for the initial plant are of the oil-immersed three-phase type, with three cores and simple concentric windings, and are cooled by circulating the oil through separate water coolers. The transformers are designed for a normal output in continuous service of 29,000 kVA when the temperature of the cooling water does not exceed 50 deg. F., and 25,400 kVA when the temperature of the water does not go beyond 77 deg. F. The ratio is 12,000/144,000 volts at no load, and the connection is star-delta with secondary neutral point brought out. No extra tappings are provided for voltage regulation. The h.p. winding, which is a disk coil winding with automatic pressure devices, has specially strengthened insulation between turns next to the phase terminals and neutral point.

The bushings are of the condenser type and are provided with porcelain covers. The transformers and all other apparatus are designed for a nominal transmission pressure of 132,000 volts and for outdoor erection. The cooling equipment is, however, placed indoors in the cable-ways beneath the foundations of the transformers and oil switches. For each transformer two coolers are used which, when acting together, can dissipate 280 kW when the cooling-water temperature does not exceed 77 deg. F., and 340 kW with a water temperature of 50 deg. F. The quantity of oil which circulates through each cooler is 900 gallons per minute, and an approximately similar quantity of water is used. For circulating the oil centrifugal pumps are used, directly coupled to squirrel-cage motors and designed for a water head of 65 ft. The temperature drop in the oil passing through the coolers is arranged to be 59 deg. F. at full load, the mean temperature of the oil not being more than 68 deg. F. above that of the incoming cooling water.

The usual tests were carried out on the transformers before they left the works of the builders, and the guarantees were fully upheld. The insulation was tested hot at the following pressures:—

- Primary winding to earth: 35,000 volts for one minute, followed by 26,000 volts for five minutes.
- Secondary winding to earth and primary winding: 275,000 volts for one minute, followed by 210,000 volts for five minutes.
- Primary bushings: 50,000 volts under rain (¼ in. per minute at 113 deg.), 68,000 volts dry and 15,000 volts without visible corona.
- Secondary bushings: 265,000 volts under rain test (¼ in. per minute at 113 deg.), 360,000 volts dry and 165,000 volts without visible corona.

The transformers are guaranteed to be capable of carrying the following loads: 25,400 kVA at 11,000-12,000 volts primary and a power factor of 95 without the temperature rise in the oil and windings exceeding 122 deg. F. when the incoming cooling water has a maximum temperature of 77 deg. F.; 29,000 kVA at 11,500-12,700 volts primary without the temperature rise exceeding 149 deg. F. and with an incoming cooling-water temperature of 50 deg. F. The weights of the transformers are: core with windings 42½ tons, tank with transport wheels 11½ tons, oil 27 tons, to which must be added approximately 15 tons for the cooling unit for each transformer. They are provided with expansion vessels, calcium-chloride breathers, Buchholz relays, dial thermometers, thermo-signalling apparatus, resistance thermometers for distant reading, mercury bulb thermometers, oil and water circulation signalling apparatus, and air separators through which the oil must pass on leaving the coolers before re-entering the transformer tanks.

As the transformers had to be transported by rail their dimensions were limited by the loading gauge and a maximum permissible load of 6 tons per wheel. It was, however, necessary to transport the core, tank, accessories, and oil separately, and a special wagon was built to enable the loading gauge to be fully utilised. The overall dimensions are 10 ft. 7 in. by 21 ft. 7 in. by 22 ft.

For the sub-station at Flesaker two oil-immersed core-type transformers have been supplied, being similar to the Nore transformers, but cooled by circulating the oil through external forced-air coolers. With a maximum surrounding temperature of 95° F. the normal output is 25,000 kVA secondary and 8,000 kVA tertiary. The three separate windings, with ratios of 123,000/61,300/5,830 volts at no load, 50 periods, are connected in delta-delta-star with neutral points brought out from the primary and secondary windings. The tertiary winding is designed for connection to a synchronous condenser used for voltage regulation and compensation of the power factor; the latter is designed for an output of approximately 14,000 kVA. The transformers are of the outdoor pattern, the cooling units being erected in a separate building placed between the two transformers.

Three transformers were supplied for the sub-station at Smestad, of the same type as those described above for Flesaker, but having the following characteristic data:—

Transformer No. 1 for connection to the Oslo electricity supply network: ratio at no load 119,200/32,635/5,580 volts, 50 periods, connection delta-delta-star with neutral points of the primary and secondary windings brought out. Transformer No. 2 for connection to the Akers electricity supply network: ratio at no load 119,200/48,935/5,580 volts, 50 periods, connected as No. 1. Transformer No. 3, which is intended as a stand-by for Nos. 1 and 2, is furnished with four windings having the following ratios at no load; 119,200/48,935/32,635/5,580 volts, 50 periods, connected in delta-delta-delta-star with the neutral point of the primary winding brought out and a common neutral point brought out for the two secondary windings, which are auto-connected.

Each is designed for a normal output on continuous service of 23,000 kVA on the secondary side and 12,000 kVA tertiary, the surrounding temperature not exceeding 68 deg. F., and without the temperature rise in the windings or oil exceeding 131 deg. F. As in the case of the Flesaker station, the tertiary winding is connected to a synchronous condenser for voltage regulation and power-factor correction, and the coolers are similar also.

The transformers described were manufactured by the Per Kure Co., of Oslo, Norway, and are claimed by the *Asea Journal* to be among the largest which have so far been constructed in Scandinavia.

Electricity in Market Gardening.

In order to ensure supplies of flowers and fruit in Scandinavia, even in the cold northern winter, electricity has been pressed into the service of the market-gardeners, and the following results have been obtained:—Seeds which normally take twenty days to germinate, in soil with a temperature of 12° C., sprout three and a half days earlier if the temperature is raised one degree only. Onion seeds will sprout a week sooner if the soil temperature be raised to 22° C., and the improvement is much the same for flower bulbs.

The most effective method in use is to place the wires underground (naturally with protective covering) at a depth of 30 cm. As the earth is a good accumulator of heat it is not necessary to use current continuously, and the latest installations are automatic, cutting off the current as soon as the desired heat has been generated.

Electric Warming.

Notes on the various methods in vogue, with special reference to the low-temperature panel method.

By RONALD GRIERSON, A.M.I.E.E., A.M.I.Mech.E.

(*Abstract of a paper read before the* INSTITUTION OF HEATING AND VENTILATING ENGINEERS.)

MANY engineers are obsessed with the idea of efficiency divorced, or practically so, from all other considerations. It is true that a kilowatt-hour contains 3,400 British thermal units, while a pound of coke contains about 12,500 B.th.u., but electrical energy is the finished product, whereas coke is the raw material. A large section of the population is prepared to pay a little more for something that is a little better or more attractive than the cheapest, and *possibly* the most efficient.

Very briefly stated, the advantages of a well-designed, modern, continuous electric warming system are: its entire invisibility in the decorated room; its adjustable automatic temperature control; its low operating temperature, and its perfect reproduction of the atmospheric conditions of the most desirable days of early summer, *e.g.*, an evenly distributed warmth combined with a delightful feeling of fresh air. Many people have installed electric fires with current at 2d. per unit, or 6d. per hour for a 3-kW fire. The ill-advised electrical enthusiasts who are responsible for these early installations for any purpose other than for intermittent heating are really the electrical industry's worst enemies. In future, we must remove the possibility of switching-off continuous heating systems from the immediate locality of the user, and educate him to leave the installation on automatic temperature control. By this means he will obtain much more comfortable conditions and at the same time, curious as it may seem, he will have a lower bill for electrical energy.

I cannot refrain from commenting on the lack of vision exhibited by the majority of supply authorities in failing to grasp the advantage which the continuous electric warming load offers when it is operated by automatic temperature control. Surely such a load is entitled to a better rate than an electric-fire load which is principally switched on during the cold and foggy days—when the load is heaviest. Yet, in the majority of districts, one heating rate is quoted for all types of equipment, and this is not infrequently a prohibitive rate for continuous, thermostatically controlled equipment.

One or two supply authorities are offering a rate of ¾d. per unit between the hours of 9 a.m. and 7 p.m., and ½d. per unit for the remainder of the period. The average price paid at these rates for thermostatically controlled installations is not the average of 0.625d., but something very much nearer 0.55d. As a further inducement, I would suggest the payment of a fixed charge and a corresponding lowering of these rates, so that the annual total cost is approximately the same.

The following paragraph appeared in the ELECTRICAL REVIEW of October 4th, 1929, regarding the offer of a bulk supply to the Dover Corporation:—

> "According to the proposed scheme, the bulk supply would be taken from the Central Electricity Board's substation on Folkestone Hill at 33,000 volts, and reduced to 6,600 volts by means of transformers and switchgear provided by the Board. The supply would be metered at 6,600 volts and the price paid for the supply would be as follows: Not exceeding £3 17s. 6d. per kW of maximum demand during any half hour in the months of November and December in the year of account, plus 0.2d. per kW hour supplied, the unit charge to be subject to an increase or decrease of 0.001d. for each penny by which the cost of coal delivered to the Board stations shall rise above or fall below 16s. 6d. per ton."

As this is one of the earliest published offers of a supply from the national grid, it will be interesting to examine it with regard to the probable effect on a continuous electric warming proposition, always bearing in mind, of course, that the Board sells to the local distributor, whose distribution costs and profits must be added, and noting specially the use by the words *not exceeding*.

Consider a load of 10 kW and a consumption of 2,000 kWh per kW installed, figuring the maximum load as being 60 per cent. of the connected load; the following result is obtained:—

Connected load	10 kW.
Maximum load on mains	6 kW.
Fixed charge, 6 kW at £3 17s. 6d.	= £23 5s. or 5,580d.
Metered charge, 20,000 units at 0.2d.	= 4,000d.
Total cost	9,580d., or 0.479d. per unit.

The interesting factor of a tariff of this character is that if the consumer increases his consumption from 2,000 to 2,500 units per kW installed, he only adds, on the basis outlined above, 8s. 4d. per kW installed on his annual bill for current. In my own view, a lower fixed charge and a higher running charge would be more attractive to the consumer.

It is desirable to fix attention on one vital difference between electrical and hot-water heating. In the latter system, the maximum temperature that pipes, radiators, &c., can attain is fixed by the temperature in the flow pipe. Cover up your pipe or radiator with a blanket, and the only result is that little or no heat is emitted, and that the water leaves the pipe or radiator at the same temperature as it entered. With electrical equipment, however, the result is very different because energy is being continuously supplied to the apparatus and a steady temperature is only attained when the heat loss balances the heat input. Herein lies the danger of employing unguarded types of non-luminous heaters which are within easy reach of floor level, *e.g.*, the user may unwittingly restrict the heat loss by throwing over the heating equipment, either accidentally or intentionally, a blanket, coat or other object. Electrical devices have no final temperature and the temperature may continue to rise under the conditions named, until the ignition point of clothing, &c., is reached.

The following are some of the advantages and disadvantages of the various types of equipment available:—

Electric Fires.—Useful psychological and decorative effect; simple, convenient, and cheap in the plainer forms; quick response for intermittent heating; elements burn out and flexible conductors fail and require to be replaced from time to time; temperature gradient very severe, *e.g.*, temperature falls rapidly as distance from fire is increased, and heat shadows very marked.

Resistance-wire Convectors.—Low first cost; temperature of active parts high; "air burning" is probable.

Electric Hot-water Heaters.—Occupy floor space; soil decorations; unsightly; no labour; no boiler and pipes.

Pipe Heaters.—Floor space occupied; high operating temperature; cheap; ease of application; low temperature grade.

Plate Heaters.—Difficult to incorporate and conceal the panels.

Thermal-storage Systems.—Capital costs involved and space occupied are considerable; labour reduced to the vanishing point.

Dulrae Panel System.—Ease of incorporation in the structure; invisibility; low temperature grade; low operating temperature; perfect atmospheric conditions; elimination of labour and maintenance cost; slightly higher initial cost.

The cheapest and simplest form of low-temperature electric panel system is the embedded type, *e.g.*, insulated conductors having a comparatively high resistance embedded in plaster which is carried on a cork slab and secured to cement asbestos backboards. Standard sizes are 6 ft. by 2 ft.; 4 ft. by 3 ft.; and 3 ft. by 1 ft.; all being approximately 1½ in. thick. The 3 ft. by 1 ft. size for use, four in series, on 200/250-volt systems, has been found specially useful for fixing between the floor joists and also for situations in which long narrow strips of warmth are desirable.

All standard panels are designed for a maximum surface temperature of 120/125 deg. F., when fixed horizontally on a ceiling and operated in still air. Under automatic temperature control, the temperature, provided adequate surface is installed in relation to the heat loss, average 85/90 deg. F., even on cold days. Loading averages 40 watts per sq. ft. of active surface, or 400 watts for the standard 6 ft. by 2 ft. or 4 ft. by 3 ft. panels.

The following are a few of the innumerable methods of control: switching of individual panels in sections of 400 watts; series/parallel switching in groups of 2, 4, or 6; thermostatic control of all panels in one room; thermostatic control of the main supply and individual switching of room panels; and several panels switched on permanently and the remainder controlled by thermostats.

In figuring on automatic control, care has to be taken in large rooms to see that the load switched has a reasonable relation to the mains of the supply authority; *e.g.*, it would probably be impracticable to switch blocks of, say, 20 kW off and on at ten- or twenty-minute intervals without a flicker in the lights being noticeable. The capacity of the standard thermostat is from 10 to 12 A at 230/240 volts, *e.g.*, from 2,300 to 2,900 watts. Where larger loads are required to be switched, additional thermostats are required, or one thermostat can be arranged to control the coil of a contactor switch, or parts of the panel may be switch controlled.

The coke- or oil-fired boiler has one great advantage over the electric method—it is always possible to force the boiler and

thereby temporarily to increase the normal power of the installation at the expense of slightly lowering the efficiency. Once an electric system is fixed and connected to a constant-pressure system, the maximum heat emission is fixed. Therefore, it is essential to decide at the outset whether the electric system is to be boosted by means of electric or coal fires during spells of very severe weather or where abnormal heat is required, as in the event of sickness, or whether the electric system is to take care of all possibilities. Normally we figure on a 30 deg. rise for staircases, landings, halls and vestibules, and 40 deg. for living rooms, offices, bedrooms and bathrooms, unless otherwise directed

For a temperature rise of 30 deg. F. we find that the watts per cu. ft. calculated by the ordinary methods average 0.63 or, say, 22 superficial feet of panel per thousand cu. ft. of space, *e.g.*, the surface required is approximately 2.25 per cent. of the cube. For a 40 deg. rise the rating is approximately 0.84 watt per cu. ft., 30 sq. ft. per thousand cu. ft. of space, or 3 per cent. of the cube.

The cost of operating an electric warming system is no easy matter to estimate with any degree of precision, for the factors are so variable, accurate measurement is so simple, and the maintenance of the required temperature is so precise. Units are units, but all coke is not good coke, and all stokers are not good stokers. Both coke and stokers can be blamed by hot-water engineers. Electrical engineers can only blame the meter or the occupants of the building, or their own calculations.

From a London kinema equipped with the "Dulrae" panel system, the following figures have been obtained :—

Total load ...	31,500 watts, or 107,000 B.th.u.
Total cube ...	55,000 ft.
Watts per cu. ft.	0.586.
Consumption ...	Year ended March 30th, 1928—24,202 units, or 768 units per kW installed.
	Year ended March 30th, 1929—29,627 units, or 940 units per kW installed.

If these totals are figured as to 60 per cent. at the 0.75d. rate, and 40 per cent. at the 0.5d. rate (which is now available), the annual cost is £60 and £74, respectively. In this case, the animal heat of the audience is responsible to a considerable extent for the remarkably low figures obtained.

Electricity Meters.

Is there something fundamentally wrong with our methods of measuring electrical energy?

By E. W. HILL, M.I.E.E.

(*Extracts from chairman's address before* METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ELECTRICITY meters must have been named by default on the paradoxical principle of *lucus a non lucendo*. They do not measure electricity, but energy, which, so far as engineers are concerned, is a straightforward scalar quantity. It is an *amount*, which would not seem to be awkward to measure like *rates*, or derived quantities. We ought to be able to measure it at least accurately enough to free us from introspection and continual preoccupation about possible lack of accuracy. We are obsessed with accuracy tolerances.

When measuring energy with meters do we not now conduct an operation which, for indirectness, is comparable with the following hypothetical, but possible, method of measuring a distance? Suppose that, instead of straightforwardly applying a measuring scale to determine the distance between London and Edinburgh, for example, we traversed the distance in a vehicle, the while making determinations of its velocity as it varied from time to time, and of the duration of the journey; and that we then performed a complicated integration of velocity/time, and in that way ascertained the length of the journey. That is exactly, in principle, what practically all electricity meters do. Can no way be found of substituting a direct form for the indirect one?

The interrogation may perchance stimulate someone to seek a solution, by casting aside all preconceived ideas on the subject, but, even with our present methods, another way of escape from our accuracy difficulty seems at least not definitely closed. We dare not allow our instruments to absorb the energy that is measured; electrons are caught in our instruments, made to give an account of themselves, and then allowed to pass on to their proper business of lighting lamps or turning motors, &c. They do not get through that ordeal quite scot-free; they have to do a little work; turn a disk against a little magnetic friction, and turn the wheels of a counting train. The actual mechanical work is absurdly small; so is the levy demanded for this purpose from the electron flow; that is, small in comparison with the amount actually measured, but the disproportion between these two small amounts, *i.e.*, between the electrical input to and the mechanical output from the meter is simply amazing; it is of the order of 50,000 to 1. Why cannot a meter, considered as a motor, converting electrical energy into mechanical energy, be more efficient than that? Admittedly a very small motor is in general less efficient than a large motor; a kind of anti-relativity principle reigns in this domain. In the presence of the eternal urge towards cheapness, manufacturers dare not make their meters much more efficient, in the sense I have just used the word, for the reason that higher efficiency means higher driving torque for the same watt loss; higher torque necessitates stronger permanent magnets to damp down the disk movement, so that even a modest four-fold increase of efficiency would involve a positively prohibitive cost for the necessary permanent magnets. This is, indeed, not a fanciful notion. Manufacturers cannot afford to make ordinary meters, at prevailing prices, with torques much higher than they are now. May I suggest this as the reason why meters are not made for more accuracy than they actually are?

Do we really want more accurate meters? An unqualified affirmative answer might not altogether be justified. I conceived the real function of meters to be to provide equitable and determinate means, rather than any arbitrary means (leading to approximations only) of fixing the relative amounts of individual consumers' contributions; but, under the guise of two-part tariffs, arbitrary means are becoming more and more prevalent as part at least of the modern systems of charging. Charges by assessment cannot, at least at present, be adopted to the exclusion of all other factors, mainly for two reasons, *viz.*, the risk of waste by negligent customers, and the wide diversity of capacities for the consumption of energy of different consumers. For equity's sake, exact a tariff based on accurately ascertained facts and costs, which involves, amongst other things, as a *sine qua non*, extremely accurate metering. This raises a consideration of some importance. As regards both price and watt loss, manufacturers have, figuratively, been driven down a kind of asymptotic curve. Even this statement may be too sanguine, since an asymptote implies a limiting value, and I am not sure that there is yet one in sight for this process, except by zero. However admirable this tendency may be from the users' standpoint and for its disciplinary effect upon the manufacturer in imposing upon him in respect of cost, increased efficiency of production, and in respect of low losses, increased economy in the use of material, it is a tendency containing elements of danger; one reason, among others, being that it is an undiscriminating tendency embracing all kinds of meters, large and small. A broad distinction should be drawn between small meters, in which case low prices and low losses are admittedly important features, and large meters in which those features sink into relative insignificance. The manufacturer should surely be allowed a little more margin, economic and technical, to enable him to supply a better, more accurate, meter for really important supplies; especially when so many large meters have demand-indicator attachments upon the readings of which the transfer of much money depends.

How curious it is that the exigencies of the conditions governing electrical generation and supply, combined with the efforts of the tariff builders, have imposed the necessity of providing for the automatic measurement of a quantity based upon so artificial a conception as that of an average maximum demand. It is a conception which involves a necessity unparalleled in any system of measurement other than electrical. We still await tripping apparatus endowed with prescience, capable of holding its hand, as it were, and being ready to start a resetting period just when it can foresee the immediate incidence of a period which is going to embrace the true maximum load. As though the artificiality of the maximum-demand conception were not enough, we superimpose upon it the even more transcendental idea of kVA, the problem of its measurement, and its collateral, power factor.

TABLE I.—PROGRESSIVE IMPROVEMENT OF INDUCTION METERS.

Aproximate date.	1890.	1896.	1905.	1913.	1929.
Space occupied, cu. in.	900	300	165	135	75
Total weight, lb.	80	15.5	8	4.4	2.75
Weight of voltage element, lb. ...	14	3.7	1.2	0.7	0.44
Weight of current element, lb. ...	11.5	1.5	1.2	0.4	0.28
Weight of disk, oz.	2.1	4.7	1.1	0.9	0.8

Meters are now, it may seem, much as they ever were, yet there has been definite progress on the technical side, in new designs for special purposes, in economy of material and space (a condensed summary of which is given in Table I); in elegance of construction, and, hidden beneath and underlying all, in subtleties of design.

A French Interconnected System.

The electricity generating plant and distribution network of the Societe Electrique de la Siderurgie Lorraine.

By L. A. E. SEKUTOWICZ and A. EVAIN.

(Extracts from a paper read at a joint meeting of the British section of the SOCIETE DES INGENIEURS CIVILS DE FRANCE *and the* INSTITUTION OF ELECTRICAL ENGINEERS.)

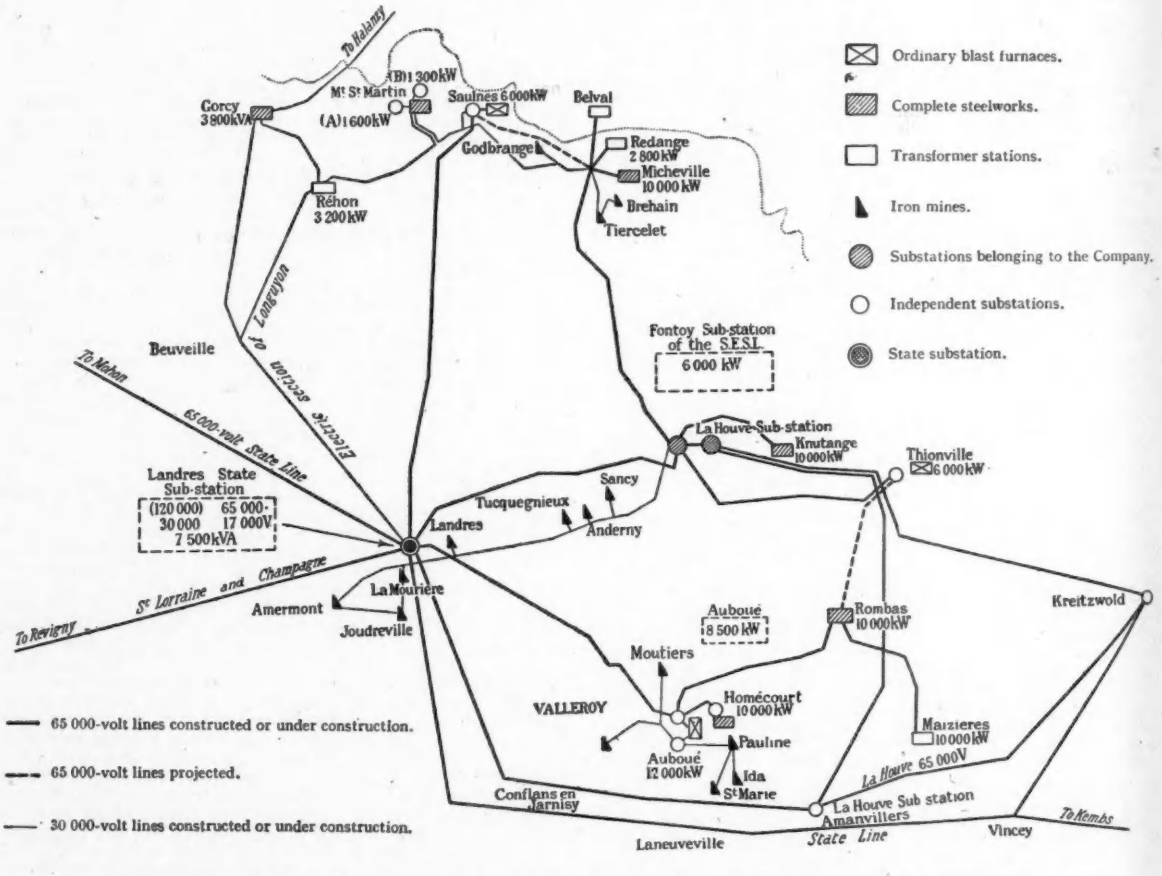
AS far back as 1918, and therefore during the course of the war, the Mining and Metallurgical Technical Commission of France foresaw the necessity for the reconstruction of the mines and works which had been devastated in the Lorraine region, and for the construction of a network to transmit electrical energy to them during the period of reconstruction. The ultimate aim was the permanent pooling of the means of production of electrical energy by running the metallurgical power stations in parallel in order to ensure the regularity and continuity of the supply of energy to the works; the transmission lines were also to be designed to allow of the sale of energy generated by surplus blast-furnace gas.

The firms which were brought under consideration comprise, at the present time, excluding the Belgian and Luxembourg works, eight pig-iron foundries (excluding steelworks) with 30 blast furnaces; and 12 complete works, with blast-furnaces, steel-producing plant and rolling mills, comprising 70 blast furnaces. These works are capable of supplying annually 7 million tons of cast iron, which corresponds to a total output of 3.6 million cu. m. of blast-furnace gas per hour.

Deducting from the above the needs of the blast-furnace services proper (the heating of the cowpers, blowers and accessories), it should theoretically be possible to dispose of 1.8 million cubic metres of gas per hour for purposes other than blast furnaces, which is equivalent to 240 tons of coal per hour. Assuming a calorific value of 7,000 calories per kg, this should produce from 300,000 to 400,000 kW, according to the system employed, *i.e.*, gas engines or turbines. If we take into account the amount of energy required for the purposes of the central stations themselves, we can estimate a surplus amount of energy available for sale of up to 100,000 kW.

The installations that have so far been completed comprise 10 works, which include 60 blast furnaces.

In order to carry out this programme the principal metallurgical companies and the Omnium Lyonnais (a firm which specialises in the industrial applications of electrical energy and was to provide the technical service of the future company) grouped together to form a technical department for the construction of future schemes, and in 1920 created the Société Electrique de la Sidérurgie Lorraine with a capital of 8 million francs. Negotiations with the Government were successfully concluded in 1924. The concession to transmit



All lines comprise 6 conductors. Capacities indicated in kW are only those of the machines actually supplying the network.

Fig. 1.—The Network and Distribution Area of the Company.

applied to the creation of an aerial ring-main at 65,000 volts tied-in to the State station at Landres, which was built earlier on the 120,000-volt line which connected some Swiss works and the works in the French Ardennes, and the network at 65,000 volts from the mines of The Houve (Fontoy sub-station). These two distribution concessions gave rights for a ring main of 30,000 volts to connect the mines (and the less important works) to 65,000/30,000-volt sub-stations, which were connected to the high-voltage network, as shown in fig. 1. The initial programme should be completed very shortly by the installation of new power stations designed to utilise the surplus gas products in each of the metallurgical works forming part of the group.

Only by adopting the programme as a whole could the advantages of the system be fully realised. During the whole of Sunday when steel production is at a standstill the total

amount of gas production is available. During working periods there is also surplus energy, but it varies considerably during the course of an 8-hour shift, as it represents the difference between a relatively constant total production and the extremely variable needs of the steel-producing plant and of the rolling mills. The shape of the load curve resembles rather closely that of a traction system.

General parallel running attenuates very considerably the relative importance of peaks, and regularises the voltage and frequency, and so allows of a considerable increase in the production of rolled steel, which has given much advantage to the steelworks connected to the network. Furthermore, it reduces the amount of stand-by plant, as at any time and nearly everywhere at certain hours there is a surplus amount of gas. This method of running produces further energy at no cost other than that which corresponds to a reinforcement of the gas-washing plant. The very great advantage of being able to run on light load only those generators whose efficiency is satisfactory under these conditions has not been lost sight of, and the possibility of the mutual interchange of power in the case of accident is of further advantage to the system. But, however advantageous the recuperation of energy during working hours may be, the utilisation of the energy which can be produced by employing waste gas, particularly during the change-over periods, is even more important. Labour off-periods are grouped during the night when the available energy is difficult to utilise on neighbouring distribution networks. In order to obtain a market for the surplus, it is necessary to feed a very large area in such a way that some steam power stations may close down entirely during the night.

Some fear that operation would be difficult in practice was based on the irregularity of the generating sets (4-stroke blast-furnace gas engines with either two or four single- or double-tandem cylinders). The relative importance of peaks decreases with the number of interconnected production centres, and it was therefore sufficient to connect such engines together by a sufficiently small impedance, and to run the machines under conditions which would approach parallel running with short connections from terminal to terminal. The impedance of the company's 65,000-volt lines is of the order of 0.42 ohm per km., and experience has confirmed this view. For the secondary networks, after a period of indecision, the company decided to adopt a voltage of 30,000, and practice has entirely justified the choice of these two voltages.

The factor of safety of the insulators was made sufficiently high to avoid the risks of perforation, even at a voltage much in excess of the flash-over voltage. In the sub-stations, surge protective gear was limited to the adoption of shunted inductance coils connected to each outgoing feeder, and transformer insulation to earth was very high (sufficient for three times the working voltage) and the insulation between turns was designed to withstand the full working voltage. Thus the insulators work rather effectively as voltage-limiting devices, although this is not their rôle. However, the lack of selective protection has made itself felt and is now under consideration, as is also the general earthing of the neutral, and the methodical reinforcement of insulators in the more exposed regions.

With regard to the sub-stations, the outdoor type was adopted from the beginning. In spite of the production by certain works of conducting dust in very large quantities, this system has not given rise to accidents in operation, and has effected certain economies in building up the network, which might have been paralysed at its inception by the financial crisis of the franc. The works sub-stations (65,000/6,000 volts) are simply liaison sub-stations for the network, and at the same time serve as disconnecting or by-passing sub-stations, and can be disconnected from the circuit without interrupting the continuity of the ring. Although the first core-type transformers have given entire satisfaction, the company is experimenting with the shell type, which appears to be stronger and to withstand the effects of short-circuits more effectively.

The distance between the furthest stations does not exceed 60 km. Of the 15 stations situated in the French part of the mining area, 10 are connected to the network. The total amount of power of the latter is of the order of 125,000 kW, but all the units are not permanently connected to the network. The machines are as follows:—

5 gas 4-cylinder engines	22,000 kW
20 gas 2-cylinder engines	50,000 kW
15 turbo-alternators	45,000 kW
6 convertor groups connecting up works which run on d.c. ...	9,200 kW

(The total power of the d.c. works is approximately 30,000 kW).

The total power connected to the network is therefore supplied by 40 miscellaneous units, in the following proportions: gas engines, 56 per cent., steam turbines, 36 per cent., and convertors, 8 per cent. If we include the generating units in the stations supplying the convertors, the proportion of steam turbines drops to 32 per cent.

In the first period of its development (1920-1923) the company concentrated on the interconnection of mines in order to facilitate pumping. To this end it constructed sub-stations and local lines at 30,000 volts. In 1924-1927, after having adopted the general plan of the network, 65,000-volt lines were constructed, and at the beginning of 1928 the majority of the larger works of the company were connected together. The third period (1928-1929) began with duplicating the lines, which were still provisionally of the 3-wire type, and completing the ring. In 1929 a new and greatly extended programme was established, including the installation in the eight principal metallurgical centres of high-pressure turbo-alternators. When this programme is completed more than 45 million francs will have been spent by the company on lines and sub-stations, without taking into consideration the installations that have been carried out on the members' own premises (which amount to 63 million francs for new units only), a total of nearly 100 million paper francs (the gold value of which varied during the course of the work) having been invested in the scheme.

Since 1926 the Lorraine metallurgical group has been connected to the distributing network of the Lorraine Electrical Co., fed by a steam power station of 50,000 kW at about 140 km from Landres. It already runs in parallel with a group of Swiss hydro-electric power stations. In the ordinary course of events the operation of these stations is eminently satisfactory. In particular, the normal variations of load have never given rise to any difficulty in maintaining the normal voltage at the points where the supply is used, nor has it been necessary to install any synchronous condensers or induction regulators.

Peaks of short duration, but of a periodic character, give rise to a certain amount of hunting, which would not occur if all the units were in a perfect state of maintenance and if they were automatically tripped out as soon as their running became irregular. It is hoped to achieve this result by means of reverse-power relays. An examination of this phenomenon by one of the authors' colleagues is summarised in the paper.

The difficulties encountered are not sufficiently serious to cause the advantages of parallel running in general to be lost sight of. By increasing the total interconnected power to its maximum the relative importance of disturbances is diminished, peaks are reduced, and loss of gas becomes a minimum. But in the present state of the art and with a view to giving the maximum satisfaction to the consumers, the company takes advantage of the existence of 6-conductor lines over the whole of its network, and provisionally runs two distinct circuits. The first interconnects pure blast-furnace works and runs in parallel with the large neighbouring supply companies. The second connects the steelworks to its network and consequently is subject to variations in voltage and frequency of a much higher order; these are, however, very much smaller than they were before interconnection was adopted. The overall efficiency of the installation is thereby greatly improved, and the production of finished metal is increased under conditions which would themselves almost justify the enterprise.

It is easy to determine the principles on which the commercial relations of a group of consumers and producers of electrical energy should be based, but difficult to establish a fixed plan. For instance, the treatment of its participants should be on a basis of rigorous equality, but when the elements upon which it should be based come to be defined divergencies of opinion appear. The Union des Centrales de Liége allowed its producers a certain amount of competition, but assured to each of them an equal profit, whereas the Metallurgical Company did not take into consideration the profit accruing to its participants for the sale of their energy, but guaranteed that every participant should receive equality of treatment as regards quantity and price.

The Union des Centrales de Liége functions as a co-operative society, whereas the Lorraine metallurgical group functions as a clearing house. The Union supplies through its network industries of very diverse natures; some producers and others consumers; the service rendered by the Union by taking energy from the former and delivering it to the latter has therefore a very particular characteristic; the operations of buying and selling are confined to the co-operative partners and thus lose all commercial appearance. The Lorraine metallurgical group, however, supplies through its networks, almost exclusively, metallurgical concerns which are producers of energy; in this case it is not purely a question of mutual exchanges between the participants.

The load dispatcher is situated in the centre of the network at Briey, and has power to control the running of machines, if necessary; in particular he can have any machine stopped which causes disturbance in the network, and he can also order another machine to be connected to a network, provided one is available. He arranges the running of machines and, in particular, the supply of wattless current. In his office there is no apparatus for measuring energy, but only hand-operated panels which show him the state of affairs at every part of the network, and the condition of the machines in the various stations; in addition, he is connected by telephone to all the switching and central stations, and periodically receives information as to the running of the network. His task is, in fact, to ensure continuity of service.

The central stations which have been connected to the network had been designed to cope with the internal needs of the works, and not to the possibilities of production by blast-furnace gas. In consequence, in nearly all the works belonging to the company there was a surplus of gas not utilised, which constituted a source of energy of about 50,000 kW. In order to exploit this, it was necessary to install in every works the means of production. The question was whether gas engines or steam turbines should be installed.

The defenders of the gas engine admitted that it lacked elasticity, and was not suitable to deal with such an irregular consumption as that of a rolling mill. They therefore added

to their gas engine a turbine partially fed by steam produced by exhaust boilers, thus regularising the running of the gas engine by means of the turbine in such a way as to absorb the peaks and to increase the thermal efficiency of the installation from 23 to 26 per cent. (for engines without scavenging), whereas a steam turbine fed by high-pressure boilers had an efficiency of 21.6 per cent. Translated into cubic metres of blast-furnace gas, these figures gave the following consumptions:—

Gas engines with regenerative boilers—3.8 cubic metres of gas per kWh at the terminals.

Steam turbines with high-pressure boilers—4.6 cubic metres of gas per kWh at the terminals.

In other words, 100 cubic metres of blast-furnace gas would give with gas engines 26 kWh, and with turbines 21.7 kWh. Therefore the gas engine shows an efficiency in kWh which is 20 per cent. better than the efficiency of the turbine. In spite of this advantage, which is to a very great extent compensated by the high cost of manufacture and operation, the use of turbines has been adopted in order to reduce the proportion of gas engines running in parallel on the network.

At the present time the power produced by gas engines represents 56 per cent. of the total in interconnected stations; the importance of the turbines which are running is too small to enable a practically constant frequency to be maintained. The new installations will reduce the above figures to 40 per cent. and will give the turbines a preponderating effect, without which the network would be liable to cause disturbances in neighbouring networks. The author does not condemn the gas engine, which, under certain conditions, more particularly in connection with isolated works, may be preferable to the turbine on account of its higher efficiency. Turbine central stations are at present being installed in seven works belonging to the group. Their total power will be 64,000 kW distributed over seven turbo-alternator units, five being of 10,000 kW and two of 7,000 kW. Each station will comprise one group only, but provision has been made for installing eventually a second unit, which most probably will be of a more powerful type. The steam characteristics are a pressure of 35 kg/cm² (497 lb./sq. in.) and a superheat of 425 deg. C. In works which have coke furnaces at their disposal, burners are provided for employing blast-furnace or coke-furnace gas, either together or separately. Automatic regulators in each boiler will maintain a constant pressure of steam and will not call upon the coke-furnace gas until the whole of the blast-furnace gas has been utilised. It would appear to be the practice of the future to install steam generator units of a capacity such that the whole of the output of blast-furnace gas can be utilised at any moment, and to allow the boilers to feed a high-power turbo-alternator set designed with a heavy overload capacity. The works which produce their electricity with a single machine should have means of stopping periodically, and at the same time allowing their gas to be utilised by other sets. A 10,000-kW group costs less to install than a 2,500-kW gas engine. In most cases overload can only be obtained by using fuel which is independent of the works, and this fuel can only be pulverised fuel. In the new steam stations of the company each of the five units of 10,000 kW is designed for an economical load of 8,000 kW and for a continuous overload of 12,000 kW in four of the stations. The supplementary load of 4,000 kW can be obtained exclusively with pulverised fuel. The stoppage of one of the turbines can therefore be entirely compensated for by forcing the others with, if necessary, the utilisation of pulverised fuel until the station in which the stoppage has occurred has put its reserve units into service.

The conclusion is that the Lorraine Metallurgical Company has solved the problem put to it, and exchanges of energy have exceeded the figure which was predetermined at the outset as being necessary in order to make a sufficient return on the capital invested.

The number of kWh transmitted by the network of the company from the commencement, is as follows: —

1923	7,931,074
1924	22,413,015
1925	36,555,028
1926	65,703,130
1927	89,732,038
1928	112,403,727

In 1929 the total production will reach 130 million kWh. and in 1931 will exceed 200 million kWh. The amount of energy taken into account, which has been almost entirely produced by waste gas, represents annual receipts of the order of 20 million francs. However, new stations which will be in service during 1930 will considerably increase the amount of energy available, and will permit the company to increase its radius of action. When that occurs new markets will have to be found, more particularly for utilising the energy available at night. In order to ensure new outlets for the increased production of energy, the company has already interconnected two large distribution networks in Alsace and Lorraine and in the Vosges, and has participated in the creation of two new companies which are constructing high-pressure lines to join up with the Parisian region and the north of France *via* the Ardennes.

Discussion in London.

Mr. ROGER T. SMITH read an abstract of the paper, which was printed in English, and the president of the British section of the Société des Ingénieurs Civils de France spoke briefly of the benefit of such joint meetings.

Four speakers only took part in the discussion; the meeting lasted just an hour.

Mr. SCOTT MACKENZIE, chief electrical engineer of the Staveley Coal & Iron Co., Ltd. (an illustrated description of which undertaking will be found in our December 13th, 1929, issue) agreed generally with the authors' conclusions. The Staveley Co. used three 5,000-kW gas-engine sets consuming blast-furnace gas of low calorific value. Such plant was somewhat costly: about £22 per kW, including some gas-cleaning plant, against about £13 per kW for turbine sets. He had had some trouble with the exhaust piping and boilers, but the engines themselves had not given trouble. The gas engines could not, however, be started and stopped as often as turbines could; the gas engines were allowed to run as long as they would, normally about 12 weeks, at full load continuously, load variation being taken by the turbine sets. Turbine plant should preponderate, preferably in the ratio of 75 per cent. to 25 per cent., and he fully agreed with the authors' statements on the subject of hunting.

Mr. ROGER T. SMITH said it was not clear from the paper whether variation of working shifts to fit the power load was an accomplished fact or not. The authors had not said much about safety; how frequently were breakdowns experienced? One naturally did not care to mention one's troubles, but such information was valuable to other engineers. The Staveley Co. did not provide selective protection for its lines, only for the generators.

Major T. RICH pointed out that the system described was another instance of the development of power, not according to the amount required, but to that available. He envied France her spirit of co-operation: whether in agriculture or engineering, her people seemed to work together naturally without outside interference. Britain, perhaps, went too far in seeking thermal efficiency, and had to pay for it in capital outlay. Where violent fluctuations in the steel market were not allowed to take place it was easier to produce power from blast-furnace gas. In view of the extraordinary elasticity of modern steam turbine sets, had the authors considered steam storage?

Mr. L. A. E. SEKUTOWICZ replied briefly in French.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Electricity Supply.

On December 11th, in the House of Commons, Mr. HOPKIN (Lab., Carmarthen) called attention to the question of electricity supply; and moved:—"That this House welcomes the progress which has been made by the electricity supply industry and assures the Government of all support in any efforts it may make to secure the utmost possible efficiency in the generation and distribution of electricity and to make available a cheap and abundant supply of energy for all industrial and domestic purposes, particular regard being paid to the needs of the rural areas and to the close relationship which should exist between the coal-mining and electricity supply industries; and this House is of opinion that electricity supply constitutes a public utility service so vital to the needs of industry in general and to the national welfare that it should be organised on such a basis that national economic interests will be paramount." He pointed out that, during the last ten years, this country had made enormous progress in electrical development. Capital invested in electricity supply rose from £342,000,000 in 1925 to £462,000,000 in 1928, while in the latter year we exported electrical machinery and apparatus to the value of £18,600,000. In 1920 we had 5,000,000 kW of generating plant, which increased to 8,860,000 kW in 1928. In the same period the energy produced increased from 9,000,000,000 kWh to 14,960,000,000 kWh. But the progress made in electrical development by other countries had been greater, mainly because they had done so much in industrial electrification. The greatest line of development in this country was to be found in connection with the rural areas, and he regretted that there was not a single word to be found in the White Paper on unemployment, just issued, on this subject. The Electricity Commissioners should have the power to force an electrical company in a town to go out into the rural areas with supplies. There was also a large field for development in the electrification of the main line railways.

Mr. WELLOCK (Lab., Stourbridge) who seconded, urged that the situation should be reviewed in order to see whether there should be increased public control. Consumers derived more advantage from municipal than from private distributors. The nature of the finance of the big combines and holding companies, such as the Greater London and Counties Trust, made it impossible for the people in the areas covered by those companies to receive cheap electricity. Every company should be brought under review by the Electricity Commissioners or some special committee appointed for the purpose. The issue of bonus shares by distributing companies should be prohibited, and facilities should be afforded for the constitution of joint holding boards where the local authorities wished to take over the complete control of the electricity undertakings in their area.

Lt.-Col. ASHLEY claimed that since the passage of the Act of

1926 they had done their best with a very difficult task. He thought the Act would lower costs. Referring to the campaign for the preservation of rural amenities, in his view some of the people in their letters to the Press were taking up an impossible position. If their wishes were carried out there would be no electricity in the countryside at all.

Mr. MACPHERSON (L., Ross and Cromarty) called attention to the rejection by a Select Committee of the House of Lords of the preamble of the Grampian Electricity Supply Bill. In his opinion there was something wrong in this.

Mr. HERBERT MORRISON, the Minister of Transport, agreed that the rejection of the Grampian Bill was not without its lessons, and it must be taken into account by any Government and any Minister of Transport in considering future legislation He welcomed the resolution. The problem of the industry was that, while gas could be made and stored until someone wanted it, electricity could not be stored. Therefore, electricity must be generated substantially at the time it was demanded; and as the demand for electricity varied during the 24 hours of the day, according to the activities of the community, there was inevitably much waste. Accordingly, the Act of 1926 laid down the principle that the Nation must control the generating plant of every electricity undertaking, using also the less efficient stations as subordinate generating plant, and gradually wiping out of existence stations that were not really required. If the industry had been based on that principle from the start, the country would not be faced with the present problem. After reviewing the progress already made under the 1926 Act, Mr. Morrison said this great development of large interconnected national stations would lead to a national organisation and national generation. Other stations were becoming interconnected, including many London stations. There was in hand the Central Scotland scheme for converting to 50 cycles, which was going to cost £3,194,250; the Central England scheme, costing £3,653,500, and the North-West England scheme costing £399,500. With regard to rural electrification, the development of electrical supply in the most economical way must not be allowed to interfere more than was necessary with the amenities of the countryside. The inhabitants of rural areas had to be convinced that electricity would do all that was claimed for it. He was anxious to increase the number of experiments, so that these people might see rural electrification in operation. Also, they must do all they could to solve the problem of wayleaves and overhead lines, and he hoped that landowners would co-operate with the Electricity Commissioners in that matter. Although it was a great misfortune that the coal industry and the electrical industry had not grown up hand in hand, all the talk about generating electricity at the pit-head and transmitting it over long distances, had better be accepted with reserve until the actual financial and economic facts had been looked into. At the same time, it was desirable that there should be a reasonable relationship between the two industries, and he was informed that a joint committee had been set up by the Central Electricity Board and the Coal Mining Association to investigate the situation. Careful inquiries and scientific investigations were still proceeding into the possibility of generating electricity from the Severn. Undoubtedly, water power supply was a possibility which ought to be carefully examined.

He hoped that the electrical supply industry, which was one of the most progressive industries in the country, would reject the policy of high prices, quick profits and a quiet life. The Government had issued a circular to the industry making suggestions, and there were signs that the industry was making a response. Rapid development was required in order that the capital might be used in the most effective way. They would have to face the question whether this service could be safely left partly in private hands or should be taken into the hands of the community and used definitely for the national good. The industry was so vital to the nation that it might be desirable that it should be run as a public utility service, with proper business management and commercial instincts.

Sir PHILIP DAWSON (U., Lewisham, W.) who supported the motion, referred to what he described as " the very wonderful work " carried out in a comparatively short time, by the Central Electricity Board. He did not agree that railways should be outside the scheme. He believed that under ordinary working conditions, sections of main line railway where the traffic was such as to justify electrification would be able to purchase their energy in bulk from the Central Electricity Board at prices well below .4d. Cheap overhead lines were essential if rural demands were to be supplied. He suggested that the Government might guarantee the interest on the capital provided for electrification in any industry, provided it was satisfied that the undertakings would become self-supporting in a reasonable time.

Mr. GEORGE BALFOUR (U., Hampstead), who also supported the motion, refuted the suggestion that municipal control was better and cheaper than private control, and that the prices charged by private undertakings were necessarily too high.

After further discussion, the motion was unanimously agreed to.

Electricity Areas.

On December 11th Mr. EDE asked the Minister of Transport if he would state the areas which were covered by Joint Electricity Authorities and Joint Advisory Boards, respectively, in Great Britain; what proportion these were to the total area of Great Britain; and would he give similar statistics based on population.

Mr. HERBERT MORRISON said that the four areas which were covered by Joint Electricity Authorities were London and Home Counties, North Wales and South Cheshire, West Midlands, and North-West Midlands. The areas covered 7,560 square miles, or 8.5 per cent. of the area of Great Britain, and included a population of 10,307,000 or 24.3 per cent. of the total population. The four areas which were covered by Joint Advisory Boards or Committees were South-West Midlands, South-East Lancashire, East Midlands, and Mid-Lancashire. The areas covered 4,636 square miles or 5.3 per cent. of the area of Great Britain and included a population of 6,818,000 or 16 per cent. of the total.

Wayleave Agreements.

On December 11th Lt.-Col. RUGGLES-BRISE asked the Minister of Transport if he would give a definite interpretation of Clause 13 of the draft form of wayleave agreement issued by the Electricity Commission and, in particular, state whether that clause was an over-riding clause whereby rights saved to undertakers extended to the case of land required by the grantor for any of the purposes set out in Clause 9.

Mr. MORRISON said that the document referred to was merely a provisional draft which had been circulated for the consideration of the parties interested. The Electricity Commissioners were prepared to consider any observations received. He understood that the intention of the Commissioners was that the rights saved by Clause 13 of the document should not extend to land required by the grantor for any of the purposes set out in Clause 9.

The Coal Mines Bill.

The text of this Government Bill was published last week. It contains provisions for the establishment of coal-marketing schemes under the supervision of a Central Council and District Executive Boards, formed by the coal owners; the reduction of hours to 7½ per day from April 6th; the setting up of a National Board to deal with wages, hours and conditions in the industry; and the appointment of National and District Committees of Investigation, upon which consumers will be strongly represented, to make recommendations to the Board of Trade with regard to any matters which it considers detrimental to the public interest.

Legal.

Oxford Corporation v. Oxford Electric Co., Ltd.

Mr. JUSTICE BENNETT in the Chancery Division on December 11th commenced the hearing of an action by the Corporation of the City of Oxford against the Oxford Electric Co., Ltd., claiming a declaration that by virtue of the Oxford Electric Lighting Order, 1890, and a notice given in December, 1928, the Corporation was entitled to purchase and the company was bound to sell its undertaking as from the date of the notice. The Corporation further claimed that the price to be paid was to be fixed by ascertaining the amount of the company's capital as shown by its books to have been properly expended upon the undertaking at the date of the notice, and calculating its income at £5 per cent. on that capital, and then capitalising the income by multiplying it by the appropriate number of years purchase. To find the number of years purchase the Corporation maintained that the value of money at the date of notice to purchase had to be taken. It further claimed that it was entitled to the profits of the undertaking as from the date of the notice. Finally, the Corporation asked for specific performance of the defendants' obligation to sell the undertaking and for an inquiry to ascertain the price payable in Corporation stock. The company said that the statement of claim disclosed no facts or circumstances upon which the Court could make the declaration asked for, and counterclaimed for a declaration that the undertaking which was purchaseable by the Corporation did not include the defendants' works, premises, appliances and plant outside the city area defined in the 1890 Order. The company further sought a declaration that the profits of the undertaking would not belong to the plaintiffs until the completion and payment of the purchase price.

Mr. Tyldesley Jones, K.C., and Mr. Wilfrid Hunt appeared for the Corporation, and Mr. Wilfrid Greene, K.C., Mr. Craig Henderson, K.C., and Mr. Ronald Burrows for the company.

Mr. TYLDESLEY JONES, K.C., for the applicants, said that the city had been extended by Act of Parliament since the date of the original Order. The defendant company was authorised to supply electricity in both the old and the later area. The Act expressly provided that nothing was to affect the rights of the Corporation to purchase the electricity undertaking. In 1892 the defendant company constructed a generating station in the old city and laid mains. In 1924 it extended its mains into the area which had been added to the old city. In 1928 the City Council resolved to purchase the electricity undertaking at a price to be ascertained, in accordance with the 1890 Order, and the Electricity Commissioners gave their consent to the purchase. In reply to the Judge, Mr. JONES said the approximatte number of years purchase would be fixed at the inquiry which he would ask his Lordship to direct.

Mr. Greene, for the defendant company, said that he took the view that the question would not arise.

His Lordship said he understood that the defendants were saying that plaintiffs had to pay 20 years purchase of the net profits.

Mr. Jones replied that that was so. The Corporation said it should be 5 per cent. per annum on the capital of the company properly shown to have been expended. That meant the profits of the undertaking were to be taken for this purpose at 5 per cent. per annum. That would be a very reasonable profit at the date of the original order (1890). Electricity undertakings were not entitled to make unlimited profits. If the defendants were getting an excessive return on their capital the Corporation was entitled to apply to the Minister to make an order reducing the charge to bring profits within reasonable limits.

The hearing was continued on December 12th, when Mr. Wilfrid Greene, K.C., for the company, said the term "capitalised net profits" was used in the 1890 Order, and it could only refer to something real and not to something imaginary. If they took an imaginary rate of profit of five per cent., how could they describe that as net profits? What plaintiffs were contending for was not the capitalisation of net profits, but the capitalisation of a purely imaginary figure of five per cent. Mr. Tyldesley Jones had assumed that the Legislature intended to treat five per cent, as a reasonable return in 1890. But in that year electric lighting was in its infancy, and people would not expect five per cent. profit from such an investment. It was clear the basis on which the plaintiffs were proceeding was that less than 20 years purchase was the proper price. Five per cent. to-day from an electric lighting undertaking would not be sufficient for the ordinary investor. If the construction of capital expenditure put forward by Mr. Jones were to prevail, it would mean that over £111,000 of capital expenditure would pass to the Corporation without its paying anything for it.

The hearing was concluded on December 13th.

Mr. Greene further said that it was inconceivable that the law would lay it down that every penny earned by the defendant company while carrying on as trustees should go into the pockets of the Corporation. The purchase price should be calculated on the profits down to the date of the notice, because the capital expenditure on the basis of which the purchase price was to be asertained was capital expenditure down to the date of the notice. If after the date of the notice defendants laid down a main, that was something outside what they contracted to sell. What the Corporation was buying was the undertaking as it existed on December 3rd, 1928, that undertaking being liable to a compulsory increase after that date at defendants' expense. The addition which had been made by the defendants since the date of the notice could not be severed from what the Corporation had to purchase.

Mr. Tyldesley Jones, replying to Mr. Greene's case, said it meant that capital expended in the outside areas of Oxford which was not remunerative was to be taken as earning the same profits as capital expended in the densely occupied city of Oxford itself.

Mr. Justice Bennett reserved his judgment.

Alleged Fraudulent Consumption of Electricity.

At the Ipswich Police Court last week, John G. Pateman was charged with the fraudulent consumption of electricity from the Corporation supply.

A solicitor for the prosecution said that when the defendant's electricity meter was examined it contained a shilling, two foreign coins and a metal washer. Four shillings' worth of electricity had been used. The practice was becoming prevalent in Ipswich, and that was why the case was brought to the Court.

A meter reader and an inspector gave corroborative evidence, but the latter stated that on previous occasions when spurious coins had been found in the meter Mrs. Pateman had repaid him.

The magistrates decided to dismiss the case, but issued a warning to the public not to follow this practice.

Birmingham District Power and Traction Co., Ltd.

In the Chancery Division last week, Mr. Justice Bennett approved a scheme of arrangement with regard to the company's capital.

Counsel for the company said that it was proposed to consolidate the preference and ordinary shares into shares of one class, with equal rights in the event of a winding-up. It was also proposed to distribute one bonus share for each share held.

Popularity of Electrical Appliances.

In the last test made by electrical societies in Oslo to find out which electrical appliance the Norwegians considered most useful, the following results, in order of voting, were obtained: 1, irons; 2, cookers; 3, cleaners; 4, heaters; 5, bath-heaters.

The Electrical Company of Oslo had offered 18,000 crowns' worth of prizes in the form of current free of charge, and the electrical shops offered electrical apparatus to the value of 3,000 crowns, making the total prize equivalent to 31,000 crowns.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Standardisation of Sizes of Advertisement Pages.

We have been very glad to see the correspondence in your columns on this subject, as it is one on which we feel very strongly. One of the great difficulties of the engineering advertiser has been that his preparatory charges were so disproportionate to the actual cost of space, due to the fact that while a "national" advertiser could repeat his advertisement in paper after paper, the engineering advertiser had to have fresh blocks and perhaps even a new drawing for almost every medium.

Undoubtedly, such a concerted movement for a standard page size will involve many difficulties for the trade journals themselves, but we are sure that they will meet these difficulties in a sympathetic way, bearing in mind that such a reduction in the preparatory charges will release a certain amount of money for expenditure on actual space.

We greatly hope that in a vast majority of cases it will be possible to standardise on the size of 10 in. by 7 in. without making use of the two alternatives put forward.

Brookhirst Switchgear, Ltd.,
H. M. Goody, *Publicity Manager.*

Chester, *December 13th*, 1929.

We understand that you have recently received from the Incorporated Society of British Advertisers a letter regarding proposals for the standardisation of the advertising page size in British trade and technical journals to the three sizes: 11¼ in. by 8 in., 10 in. by 7 in. and 9 in. by 6¼ in. We are heartily in favour of these proposals.

Evershed & Vignoles, Ltd.,
A. W. Swan,
Publicity Department.

London, W.4. *December 13th*, 1929.

The All-electric House.

Referring to Mr. W. T. Wardale's letter in your December 6th issue, of late I have been going into the question of relative costs and proved a few details.

A good coal fire burns about 5½ lb. of coal every two hours, with coal at 46s. a ton or ¼d. per lb. This works out at nearly ¾d. per hour, and is attended by dust and smoke when the wind is in the wrong quarter.

The following estimates are based on the charges given below:—Electricity, lighting, 5d. per kWh; heating, 1d. per unit. Gas, lighting, 9½d. per therm; heating 8¾d. per therm.

Gas fires (I lived in a house for some months where we had seven) averaged out at 1½d. per hour. Electric fires cost 1d. 2d. or 3d., according to the size of fire.

I found, as Mr. Wardale evidently did also, that gas fires, although warm and convenient, produced sleepiness. For ordinary room lighting, a 100-watt electric lamp costs ¾d. per hour, but gives greater illumination than the inverted incandescent light (gas), which costs 1d. for four hours. A 60-watt electric lamp gives 16.6 hours per kWh, practically 3.3 hours for 1d.

As regards hall lights, a 15-watt electric lamp gives 13.2 hours for 1d., whereas a small inverted incandescent gas light gives 12.5 hours for 1d., but it can be turned down, and kept ¾-full-on giving 16 hours for 1d. The difference here is that the gas even when fitted with a protective "bell" discolours ceilings.

As regards cookers—to cook for 5 persons—the oven portion costs with gas 1¾d. per hour, and with electricity for the same number of people 1¾d. per hour.

The above shows that electricity compares favourably with gas, especially when cleanliness is considered and taken into account.

Thos. Barton, B.Sc., A.M.I.E.E.

Wigan, *December 7th*, 1929.

My Electric Home.

I have used the following apparatus in my home for the last 12 months: cooker, storage water heater (for all domestic water supplies) thermostatically controlled throughout 24 hours, refrigerator, kettle, iron, toaster, vacuum cleaner, four radiators, and sundry other small heating apparatus.

No gas or coke is used, and not more than 30 cwt. of coal for room-warming in severe weather.

For the last 12 months my wife and I have used a total of 4,450 units, costing £16, at an average price of ¾d. Thus, for about 6s. per week, we have all the advantages of electricity. The cleanliness and convenience alone are worth at least a quarter of the above sum, and I gladly spend it rather than suffer the smelly fumes, dirt, and general inefficiency associated with all other forms of heat.

That is the point that so many seem to miss, including engineers who should know better. Electricity is a totally different form of fuel from others and is not comparable on a heat basis. There are numerous collateral advantages of electricity that the others do not possess. No matter what the

application is, these advantages are worth a considerable proportion of the total cost. Some people will wallow in dust and fumes and suffer endless inconvenience and discomfort to save some paltry sum. Get them to realise the true value of the cleanliness, convenience, and efficiency of electricity, and they will use it freely.

Sales.

December 11th, 1929.

A Demand for Shoddy Materials.

I think the following extract from a letter received by us a short time ago will interest you, because it certainly appears that a fair amount of electrical material used in connection with certain building contracts is of very questionable quality.

"We shall be pleased to hear from time to time if you get any job electrical stuff, we get a lot of Council houses and we have to cut very fine to secure these contracts, so that a little job line now and again helps the thing through. Thanking you in anticipation."

It would be rather interesting if we could have some idea of the names of the various Councils which, by price-cutting, or disregarding price-cutting, allow this sort of thing to go on. The original letter is available for inspection at our office.

Bromley-Langton Electric Wire and Insulator Co., Ltd.,

F. C. LANGTON, *Director.*

London, W.1, *December 10th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

14,782. "Apparatus for effecting a graphic recording accompanying the electrical impulse transmission, more particularly for automatic or semi-automatic telephone apparatus." A. H. Marks and P. Russell (legal representatives of E. C. R. Marks, deceased). (Automatische Fernsprech-Anlagen-Bau-Ges.). September 18th, 1928. (321,466.)

15,033. "Electric communication cables." Standard Telephones & Cables, Ltd., E. Kaempf, and D. P. Dalzell. May 22nd, 1928. (321,947.)

15,066. "Electrically-circuited direction-indicators of the illuminated type for motor vehicles and the like." H. Hibbert. May 23rd, 1928. (321,963.)

19,944. "Coating metallic or non-metallic bodies with chromium." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 9th, 1928. (321,914.)

20,420. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 13th, 1928. (321,915.)

20,519. "Electric safety lamps, particularly miners' hand-lamps." Ceag, Ltd., G. I. Harris and T. Knoyle. July 14th, 1928. (Patent of addition not granted.) (321,949.)

22,971. "Systems and apparatus relating to television picture transmission, telekinematography, and the like." D. N. Sharma. August 9th, 1928. (Cognate application 23,410/28.) (321,935.)

24,044. "Apparatus for starting synchronous dynamo-electric machines." L. L. Matabon and C. M. Foucault. August 22nd, 1927. (296,003.)

24,067. "Electromagnets with rotary armatures." Akt. Ges. Brown, Boveri et Cie. August 25th, 1927. (296,091.)

24,145. "Metering arrangement for telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin). August 22nd, 1928. (321,956.)

24,146. "Methods of producing magnetic materials." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.,) August 22nd, 1928. (321,957.)

24,191. "Telephone systems." Associated Telephone & Telegraph Co. August 27th, 1927. (296,304.)

24,250. "Combined portable wireless set and gramophone." A. Compare. August 23rd, 1928. (321,979.)

24,329. "Automatic and semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd., and E. P. G. Wright. August 23rd, 1928. (321,983.)

24,331. "Driving electromotor for talking machines." W. Löffler. August 23rd, 1928. (321,984.)

24,334. "Automatic switches for use in telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., S. R. Smith and J. E. Ostline. August 23rd, 1928. (321,985.)

24,441. "Telegraph receiving systems." W. E. Beatty (Bell Telephone Laboratories, Inc.). August 24th, 1928. (321,990.)

24,665. "Rheostats of the grid type." E. Y. Walsh. August 28th, 1928. (321,996.)

24,943. "Electric transformers." British Thomson-Houston Co., Ltd. September 2nd, 1927. (296,446.)

25,410. "Electrical connecting devices." Igranic Electric Co., Ltd. (Pacent Electric Co., Inc.). September 4th, 1928. (322,010.)

25,473. "Systems for regulating the speed of asynchronous motors." British Thomson-Houston Co., Ltd. (Compagnie Française pour l'Exploitation des Procédés Thomson-Houston). September 5th, 1928. (322,011.)

25,768. "Electrical relays." H. V. Higgitt and Eastern Telegraph Co., Ltd. September 7th, 1928. (322,015.)

26,067. "Apparatus for reproducing mechanical movements by electrical means." M. Paul and Dr. P. Wangemann. December 3rd, 1927. (301,724.)

26,077. "Shock-absorbers for use with electric lamps." A. J. Thompson. September 11th, 1928. (233,018.)

26,291. "Electric circuit-breakers." British Thomson-Houston Co., Ltd., and H. C. Heath. September 13th, 1928. (322,019.)

26,399. "Cascade-connected electrical groups." Ateliers de Constructions Electriques de Charleroi. May 12th, 1928. (312,032.)

26,586. "Systems for the electrical transmission of photographs and the like and for television." Graham Amplion, Ltd., and W. J. Rickets. September 17th, 1928. (322,025.)

26,757. "Micro-telephones." Telefonaktiebolaget L.M. Ericsson. September 20th, 1927. (297,390.)

26,999. "Means for cooling of dynamo-electric machines." International General Electric Co., Inc. September 23rd, 1927. (297,467.)

27,170. "Recording and reproduction of sound." S. G. Brown. September 21st, 1928. (322,033.)

27,893. "Multiplex type-printing telegraphs." Western Union Telegraph Co. August 18th, 1928. (317,458.)

28,189. "Electrical resistances." Naamlooze Vennootschap Machinerieen en Apparaten Fabrieken. October 7th, 1927. (298,231.)

28,644. "Electric relays." International General Electric Co., Inc. October 6th, 1927. (298,239.)

29,519. "Galvanic batteries and the like." G. Redmayne. October 13th, 1928. (322,048.)

29,873. "Fire-alarm systems, in conjunction with telephone-exchange systems." Relay Automatic Telephone Co., Ltd., and T. M. Inman. October 16th, 1928. (Addition to 321,303.) (322,050.)

30,627. "Tanks wherein water is heated electrically." Santon, Ltd., and H. C. Sanders. October 23rd, 1928. (Cognate applications 33,835/28 and 38,141/28.) (322,055.)

31,181. "Directive transmission or reception of sound or other wave energy." Electroacustic Ges. October 27th, 1927. (299,475.)

31,311. "Automatic vehicle-controlled track-signalling devices." G. S. Oliver. October 29th, 1928. (322,063.)

31,374. "Obtaining smooth and dense electrolytic metallic deposits." Metallges. Akt. Ges. October 27th, 1927. (299,735.)

32,413. "Protective devices for electrical apparatus." Associated Electrical Industries, Ltd November 10th, 1927. (300,276.)

33,564. "Control switches for vehicle direction-indicators." V. A. Trier. November 16th, 1928. (322,079.)

33,672. "Circuits embodying iron-cored transformers." Gramophone Co., Ltd., and C. O. Browne. November 16th, 1928. (322,081.)

33,781. "Diaphragms for loud-speakers and the like." P. Bischoff. November 17th, 1928. (322,083.)

34,280. "Brush-holders for dynamo-electric machines." Soc. Anon. des Etablissements Ducellier. January 28th, 1928. (305,015.)

34,770. "Connections for electric resistances." Soc. Anon. Le Carbone. January 20th, 1928. (304,304.)

35,088. "Coupling-up of isolating switchgear." G. E. Whitehead. November 28th, 1928. (Addition to 286,429.) (322,094.)

35,089. "Electric circuit-interrupters." H. K. Ramsden and Associated Electrical Industries, Ltd. November 28th, 1928. (322,095.)

35,095. "Direction-indicating device for road vehicles." L. L. Fibbens and W. H. Gleadhill. November 28th, 1928. (322,096.)

35,303. "Control systems for elevators, hoists, and the like." Associated Electrical Industries, Ltd. November 30th, 1927. (301,473.)

35,763. "Electric transformers." British Thomson-Houston Co., Ltd., and J. C. Read. December 4th, 1928. (322,107.)

35,915. "Electric motor field control." Marion Steam Shovel Co. August 31st, 1928. (318,216.)

36,213/4. "Apparatus for influencing substances by means of high-frequency electric energy." Dr. A. Esau and C. Lorenz Akt. Ges. December 8th, 1927. (301,229/30.)

36,564. "Wheatstone-bridge filter for suppressing disturbances in thermionic-valve current-supply circuits." Hazeltine Corporation. January 20th, 1928. (304,309.)

36,866. "Photo-electric cells." British Thomson-Houston Co., Ltd. January 4th, 1928. (303,476.)

38,212. "Electrothermal release device for electric switches." Schiele and Bruchsaler Industriewerke Akt. Ges. December 28th, 1927. (303,118.)

1929.

1,019. "Reflector for illuminating devices." R. Weinert. January 11th, 1929. (322,125.)

1,106. "System of electric signalling for automatically insuring safety in railroad traffic." A. Iasquin and R. (*née* Foy) Delfosse. January 11th, 1928. (Patent of addition not granted.) (303,872.)

2,221. "Lantern or lamp for use on trains and vehicles." General Electric Co., Ltd., and E. L. Randall. January 22nd, 1929. (322,129.)

2,514. "Control systems for electric motors." G. Somajni. January 31st, 1928. (305,135.)

2,952. "Electrically-driven hair-cutting machines." R. Bosch Akt. Ges. February 14th, 1928. (306,628.)

3,218. "Time switch." Landis et Gyr Soc. Anon. March 1st, 1928. (307,014.)

6,884. "Apparatus for the electro-osmotic separation from solutions of anodic or cathodic travelling particles." Siemens-Elektro-Osmose Ges. March 15th, 1928 (307,879.)

7,531. "Processes for the manufacture of membranes for electrostatic loud-speakers." E. Reisz. March 13th, 1928. (307,794.)

8,447. "Transmitters for telephone systems and the like." Siemens Bros. and Co., Ltd., and G. F. Dutton. August 24th, 1928. (Divided application on 308,630.) (321,994.)

12,037. "Electric discharge lamps for television receivers." J. L. Baird and Television, Ltd. June 20th 1928. (Divided application on 319,304.) (321,930.)

12,038. "Television apparatus and the like." J. L. Baird and Television, Ltd. June 20th, 1928. (Divided application on 319,304.) (321,961.)

15,527. "Electric lamps." General Electric Co., Ltd. May 23rd, 1928. (312,273.)

25,706. "Protective arrangements for electric power lines or the like." R. O. Kapp and C. G. Carrothers. November 9th, 1928. (Divided application on 317,875.) (322,156.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from December 11th:—

Dyalmo. No. 505,352. Class 6. Electric lighting, power and ignition machines and parts thereof for motor vehicles and motor cycles.—M.L. Magneto Syndicate, Ltd., West Orchard, Coventry.

Solar. No. 502,340. Class 8 Radio-telephonic apparatus, &c.—British Homophone Co., Ltd., 67-69, City Road, E.C.1.

S.P., Siemens-Planiawerke (lettering and design). No. 504,861. All goods in Class 8.—Siemens-Planiawerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Pentector. No. 507,888. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Lissen, Ltd., Richmond, Surrey.

Shield (design only). Nos. 505,350 and 505,526. Instruments and apparatus for use in telegraphy, telephony, radio-telegraphy and telephony, instruments and apparatus for recording, reproducing and amplifying sound, electrical resistances, electric light transformers, and electric lamps for scientific purposes. No. 505,529. Class 13. Electric lamps and electric light fittings. No. 505,530. Class 15. Glass. No. 505,531. Class 18. Engineering, contrivances and lighting instruments. Phililux. No. 505,343. Class 13. Electric lamps and electric light fittings. No. 505,344. Glass. Philiray. No. 505,345. Class 13. Electric lamps and electric light fittings. No. 505,530. Class 15. Glass. Argaphoto. No. 505,347. Class 13. Electric lamps and electric light fittings. Photomirecta. No. 505,349. Class 13. Electric lamps and electric light fittings. Philuma. No. 505,340. Class 15. Glass. Phililite. No. 505,342. Class 15. Glass. Conex (lettering and design). No. 501,774. Class 16. Insulated connectors made chiefly of porcelain for making joints in electric cables and in the like electric conductors. No. 504,053. Class 50. Ditto made chiefly from condensation products of phenol-formaldehyde. —Philips Glowlampworks, Eindhoven, Holland. (British representatives: Boult, Wade and Tennant, 112, Hatton Garden, E.C.1.)

Kappit. No. 507,455. Class 8. Electric cables.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.

Strombo. No. 507,040. Class 13. Connecting switches for electric lamps and the like.—A. E. Howard, 5, High Holborn, W.C.1.

Aeolus. No. 507,378. Class 18. Engineering, architectural and building contrivances.—Electric Central Heating and Ventilating Co., Ltd., 157, West George Street, Glasgow.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASHINGTON.—Institute, baths and library; surveyor to U.D.C.

BANSTEAD.—Admission hospital at mental institution (£57,000); L.C.C. architect.

BILLINGHAM.—Pumping station, Port Clarence, for the U.D.C.; J. H. Hill, engineer, Haverton Hill-on-Tees.

BLACKPOOL.—Theatre, Abingdon Street, for G. B. Catlow. Cinema, Westcliffe Drive, for F. Barker.

BRADFORD.—Tenements (78), White Abbey area; city architect.

BRIGHTON.—Houses (56), Whitehawk estate; borough engineer. Shops (7), Hollingbury Place; James Morley. Elementary school, Lewes Road (£29,000) for the E.C. Operating department, Royal Sussex County Hospital; governors. Additions to Throat & Ear Hospital, Church Street; governors.

BRISTOL.—Houses (48), Horfield estate (£18,480); J. P. Ogsley & Son.

BROMLEY (KENT).—Extensions, Bromley and Chislehurst Maternity Home; P. A. Coad, architect, 90, Nightingale Lane.

BUCKINGHAM.—Senior school, for Bucks. E.C.; director of education, Aylesbury.

BURTON-ON-TRENT.—Houses (34), Gordon Street; borough engineer.

CHEADLE (STAFFS.).—School for Staffs. E.C.; education architect, Stafford.

CHELSHAM.—Extensions to mental hospital; Croydon Corporation.

CHERTSEY.—Conversion of Botley Park Mansion, Ottershaw, to home for mentally defectives, for Surrey C.C.; clerk, Kingston-on-Thames.

CHESTERFIELD.—Extensions to municipal offices; Corporation sub-committee. Machine shop, Sheepbridge Works; Sheepbridge Stoke Casting Co., Ltd.

COLCHESTER.—School, Harwich Road, for the City E.C.; director of education.

CREWE.—Men's hostel (£18,755), for Cheshire E.C.; county architect, Newgate Street, Chester.

DARTFORD.—Re-housing scheme, Howard Road; U.D.C. surveyor.

DENNY.—Housing scheme (24), with electrical work, for the T.C.; James Strang & Wilson, architects, Falkirk.

DERBY.—Municipal aerodrome; borough engineer.

DEWSBURY.—Employment exchange, Wellington Street, for H.M. Office of Works, King Charles Street, London, S.W.

DONCASTER.—R.C. church at Denaby Mill; Holton & Fox, architects, Corporation Street.

DUDLEY.—Technical college (£77,500), for the governors; clerk.

EAST MOLESEY.—Talking film studio (£350,000); Col. W. M. Power, Windsor House, Victoria Street, S.W.

ECCLES (LANCS.).—Fire station and quarters for the T.C.; borough surveyor. Business stores, Regent Street, for the Co-operative Society; secretary. Bank, for the Manchester & Salford Trustee Savings Bank; secretary.

EDENBRIDGE.—Memorial hospital; Read & Macdonald, architects, 16, Cork Street, London, W.

FOLKESTONE.—Business premises, Sandgate Road, for Bobby & Co., Ltd. Shops (16), and houses (13), for D. Pope, builder.

FULWOOD (NEAR PRESTON).—Extension of St. Cuthbert's Schools; Rev. A. Douglas, vicar.

GARSTON (WATFORD).—School (412 places), for Herts. E.C.; A. E. Prescott, county architect, Hatfield (returnable deposit of £1 1s.).

GATESHEAD.—Girls' Secondary School; director of education. School, Dunston (£20,000); Rev. L. Pickering, rector, St. Philips R.C. Church.

GLASGOW.—Houses, Auldhouse Road and Holeburn Road; Alexander McLellan, Ltd., 22, King Street, Pollokshaws. Re-housing scheme in connection with Finneston bridge; housing director. Isolation hospital; Corporation Health Committee.

GODALMING.—Houses (44), for the T.C.; Enticknap Bros., builders, Wormley

HAMPTON.—Development, Rectory Farm estate; Hampton Grammar School Foundation.

HETTON-LE-HOLE.—Housing scheme (50), for the U.D.C.; Mr. Fennell, architect.

HITCHIN.—Housing scheme (100), for the R.D.C.; surveyor.

IRISH FREE STATE (DUBLIN).—Conversion of Charlemont House, Rutland Square, to art gallery (£35,000); city commissioners.

KINGSWINFORD.—Housing scheme (42), Portway, for the R.D.C.; W. Meredith, surveyor.

LEEK.—Senior school, for Staffs. E.C.; director of education, Stafford.

LEYLAND.—Cinema, central site; surveyor to U.D.C.

LINCOLN.—Houses (16) with electrical work on Wragby Road estate, for the City Council.

LONDON (EAST HAM, E.).—Factory, Church Road; T. Anders.
(HACKNEY, E.).—Flats (50), Homerton Row; borough engineer. Factory, Knightsland Road; Burnett & Eprile.
(BRIXTON, S.W.).—Church and school, Acre Lane; Davidson, Son & Sherwood.
(SMITHFIELD, E.C.).—Offices, Central Market, Charterhouse Street (£15,000); city engineer.
(LAMBETH, S.E.).—Tenements, China Walk (£19,806); A. T. Rowley, Tottenham.

MAIDENHEAD.—New block at Isolation Hospital, for the B.C.; Lt.-Col. P. Johns, engineer, Guildhall, Maidenhead (returnable deposit of £3 3s.).

MANSFIELD.—Housing scheme (108), for the T.C.; borough surveyor.

MIDDLESBROUGH.—Houses (100), for the T.C.; Gilbert Long, Ltd., builders.

NEWARK.—Houses (56), for the T.C.; W. Smith (Newark), Ltd., Millgate.

NEWCASTLE-ON-TYNE.—Municipal aerodrome; city architect.

NEWPORT (I.O.W.).—Additions to ice factory, Coppins Bridge, for Isle of Wight Ice Co., Ltd.; Stratton and Millgate, architects.

OLDHAM.—Re-erection of portion of engineering works, Havelock Street, electrically equipped, for W. Gunther and Sons.

PORTSMOUTH.—Houses (58), North Prospect; A. Snape. Secondary school, North End (£104,419); S. Salter. 'Bus depôt, Eastney (£16,194); J. Main & Co.

PURLEY.—Houses (115), Old Lodge estate; Old Lodge Estates, Ltd.

RIPON.—Additional 44 houses for the T.C.; borough surveyor.

ROMFORD.—Factory, King Street; Mr. Cousins.

SKEGNESS.—Houses (45), Grosvenor Road, for the T.C.

SLOUGH.—Houses (2,000) and shops on Baylis Court estate; P. Ellis & Co.

SOUTHEND-ON-SEA.—Rebuilding Middleton Hotel and The Royal Stores, for Mann, Crossman & Paulin, Ltd.; William Stewart, architect, Aldgate, London. Rebuilding London Hotel; A. R. Mayston, architect, Chiswell Street, E.C.

STOCKPORT.—Houses (118), for the T.C; Thomas Davies and Son, builders.

TEDDINGTON.—New St. Mark's Church (£18,000); incumbent.

TWICKENHAM.—Houses (800), Redway Estate; Simmons and Grellier, architects. Houses (118), Alton Gardens Estate; A. Pascall and Sons, Ltd.

WALLINGTON.—Boys' secondary school, for Surrey E.C.; W. W. Finny, secretary, Kingston-on-Thames. Houses (41), Headley Avenue, for T. Markwick & Co.

WARRINGTON.—Housing scheme (162), for the T.C.; A. M. Ker, borough engineer (returnable deposit of £2 2s.). Housing scheme (50), Grappenhall, for the R.D.C.; J. L. Beckett, surveyor. Bakery, for the Co-operative Society; C.W.S. architect, Balloon Street, Manchester (returnable deposit of £1 1s.).

WATFORD.—Additional housing scheme (600), for the T.C.; borough surveyor.

WELLS (SOMERSET).—Extensions, District Hospital, with X-ray department and operating theatre; secretary.

YORK.—Extensions, newspaper works, for the Yorkshire Herald Newspaper Co., Ltd.; Blackmore, Sykes & Co., architects, Ruskin Chambers, Scale Lane, Hull.